

FIRST EDITION

Exam Oriented

# Anatomy

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## SCALP

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The soft tissues covering the cranial vault form the scalp.

### Extent of scalp

**Anteriorly-** Supraorbital margins;

**Posteriorly-** External occipital protuberance and superior nuchal lines;

**Each side-** The superior temporal lines.

### Structure

The scalp is made up of **five layers**:

#### (1) **Skin- first layer of the scalp**

- It is **thick and hairy**.
- It is joined to the **epicranial aponeurosis** through the dense superficial fascia.

#### (2) Superficial fascia [**connective tissue**] **second layer of the scalp**

- It binds skin to aponeurosis.
- **vessels and nerves to the skin pass from this layer.**

#### (3) Deep fascia – [**epicranial aponeurosis**] **Third layer of scalp.**

- It is freely movable on the pericranium.
- **Anteriorly**, it receives the insertion of the frontalis,
- **posteriorly**, it receives the insertion of the occipitalis

The **occipitofrontalis muscle** has two bellies, occipital and frontal.

- Both are inserted into the **epicranial aponeurosis**.

#### (4) **Loose areolar tissues - Fourth layer of the scalp**

- It extends **anteriorly** into the eyelids because the frontalis muscle has no bony attachment;
- **posteriorly** to the highest and superior nuchal lines;

#### (5) **pericranium. The fifth layer of the scalp**

- It is **loosely attached to the surface of the bones**.
- It is **firmly attached to their sutures**.



## Arterial Supply of Scalp

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In front of the auricle, the scalp is supplied from-

- (1) Supratrochlear;
- (2) supraorbital; and
- (3) superficial temporal arteries

Behind the auricle, the scalp is supplied from

- (4) posterior auricular, and
- (5) occipital arteries

The scalp has a rich **blood supply** derived from both the internal Anatomy and the external carotid arteries.

## Venous Drainage

- The veins of the scalp **accompany the arteries and have similar names**

## Nerve supply

In front of the auricle	Behind the auricle
<b>Sensory nerves</b> <ul style="list-style-type: none"><li>• Supratrochlear Nerve</li><li>• Suprorbital Nerve</li><li>• Zygomatico-temporal nerve</li><li>• Auriculo temporal nerve</li></ul>	<b>Sensory Nerves</b> <ul style="list-style-type: none"><li>• Great auricular nerve</li><li>• Lesser occipital Nerve</li><li>• Greater occipital Nerve</li><li>• Third occipital Nerve</li></ul>
<b>Motor nerve</b> <ul style="list-style-type: none"><li>• Temporal nerve</li></ul>	<b>Motor Nerve</b> <ul style="list-style-type: none"><li>• Posterior auricular Nerve</li></ul>

## Clinical anatomy of scalp

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- **Bleeding is more from scalp** because scalp is having rich Blood supply. **Bleeding can be arrested by applying pressure against the bone.**
- **inflammations in scalp cause little swelling but much pain.**
- **The layer of loose areolar tissue is known as the *dangerous area of the scalp*** because the **emissary veins**, which open here, may transmit infection from the scalp to the cranial venous sinuses.
- **Collection of blood in the layer of loose connective tissue causes generalised swelling of the scalp.** The blood may extend anteriorly into the root of the nose and into the *eyelids*, causing **black eye**.
- **Surgical layers of scalp**- first three layers are firmly attached with each other and cannot be separated from each other. **Wounds of the scalp do not gape unless the third layer is divided.**
- In Infants the veins of scalp are easily seen deep to the skin, so it is used for **intravenous infusion**.
- **Pericranium is adherent to sutures** so, collections of fluid deep to the pericranium take the shape of the bone, known as **cephalhaematoma**
- sebaceous glands are more in scalp. So, **scalp is a common site for **sebaceous cysts**.** *In this condition fluid is accumulated in sebaceous gland and converted into cyst.*

## POSTERIOR TRIANGLE

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The posterior triangle is a **space on the side of the neck** situated **behind the sternocleidomastoid muscle**.

### Boundaries

**Anterior:** Posterior border of **sternocleidomastoid**

**Posterior:** Anterior border of **trapezius**.

**Inferior or base:** Middle **one-third of clavicle**.

**Apex:** Lies on the superior nuchal line where the **trapezius and sternocleidomastoid meet**

### Roof

- Investing layer of deep cervical fascia.
- The superficial fascia
- Skin

### Floor

The floor of the posterior triangle is formed by the **prevertebral layer of deep cervical fascia**.

### Division of the Posterior Triangle

It is subdivided by the **inferior belly of the omohyoid** into

- **upper part**, called the **occipital triangle**, and
- **lower part**, called the ***supraclavicular or the subclavian triangle***

### Contents of the Posterior Triangle

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Occipital triangle content

#### Nerve

- spinal accessory nerve
- dorsal scapular nerve
- upper **trunk of brachial plexus**

#### Vessels

- occipital artery

#### Lymphnodes

- **supraclavicular lymphnodes**

Subclavian triangle content

#### Nerve

- **three trunks of brachial plexus**
- nerve to serratus anterior
- suprascapular nerve
- Nerve to subclavius

#### Vessels

- **Subclavian artery and vein**
- Suprascapular artery and vein

#### Lymphnodes

- **Supraclavicular lymphnodes**

## STERNOCLEIDOMASTOID MUSCLE

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The sternocleidomastoid are large superficial muscles of the neck.

### Origin

1. The **sternal head** arises from the **superolateral part of the front of the manubrium sterni**
2. The **clavicular head** arises from the **medial one-third** of the **superior surface of the clavicle**.

### Insertion

- It is inserted on the **mastoid process** *and* **lateral half of the superior nuchal line of the occipital bone**.

### Nerve Supply

- The **spinal accessory nerve** provides the **motor supply**.
- Branches from the **ventral rami of C2** are **proprioceptive**.

### Actions

- **When one muscle contracts:**
  - It **turns the chin to the opposite side**,
  - It can **tilt the head towards the shoulder**.
- When **both muscles contract** together
  - They **bring the head forwards**
  - They help in **forced inspiration**.

## Relations

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### Superficial

1. Skin
2. Superficial fascia;
3. Platysma.

### Deep

1. **Bones and joints:**
  - (a) Mastoid process above (b) sternoclavicular joint below.
2. Carotid sheath

### 3. Muscles

(a) Sternohyoid, (b) sternothyroid;

### 4. Arteries:

(a) Common carotid, (b) internal carotid, (c) external carotid

5. Veins: Internal jugular

6. Nerves: (a) Vagus; (b) accessory (c) cervical plexus, (d) upper part of brachial plexus

7. Lymph nodes- deep cervical

### Clinical Anatomy

#### *Torticollis or wryneck*

- It is the condition in which the **head is bent to one side and the chin points to the other side.**
- This occurs due to **spasm or contracture of the muscles supplied by the spinal accessory nerve.**

Although there are many varieties of torticollis.

depending on the causes the **common types** are :

- **Rheumatic torticollis** due to **exposure to cold.**
- **Reflex torticollis** due to inflamed or **suppurating cervical lymph nodes which irritate the spinal accessory nerve.**
- **Congenital torticollis** due to **birth Injury.**
- **Spasmodic torticollis** due to **central irritation**

## CAROTID SHEATH

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It is a **condensation of the fibroareolar tissue** around the **main vessels of the neck**.

It is the modification of deep fascia

### Contents of carotid sheath

- common and internal carotid arteries
- internal jugular vein
- vagus nerve.

### *Relations*

- anterior wall- ansa cervicalis
- behind the sheath - cervical sympathetic chain
- The sheath is **overlapped by the sternocleidomastoid muscle**

## CAROTID TRIANGLE

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It is the part of anterior triangle

It is called carotid triangle because it contains all the three carotid arteries

### **Boundries**

**Antero Superiorly** – posterior belly of digastric, stylohyoid muscle

**Antero inferiorly** – superior belly of omohyoid

**Posteriorly** – anterior border of sternocleidomastoid muscle

### **Roof-**

- Skin,
- Superficial faascia,
- Investing layer of deep cervical fascia

### **Floor-**

- Middle and inferior constrictor of pharynx

### **Contents**

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#### **1. Carotid arteries**

- Common carotid artery
- Internal carotid artery
- External carotid artery

#### **2. Carotid sinus and carotid body**

#### **3. Carotid sheath**

#### **4. Internal juglar vein**

### 5. Last three cranial nerves

- Vagus
- Spinal accessory nerve
- Hypoglossal nerve

### 6. Ansa cervicalis

### 7. Cervical part of sympathetic chain

### 8. Deep cervical group of lymph nodes

## Clinical anatomy

### Carotid sinus syndrome

- Pressure on carotid sinus result in **slowing of heart rate, falling of blood pressure** and syncope.
- It commonly occurs in person with **carotid sinus hypertrophy**

## CAVERNOUS SINUSES

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Each cavernous sinus is a **large venous space** situated in the **middle cranial fossa**. They are situated on either side of the body of the sphenoid bone.

- **The floor** is formed by the **endosteal dura mater**.
- The **lateral wall, roof and medial wall** are formed by the **meningeal dura mater**.
- **Anteriorly** the sinus extends up to the **superior orbital fissure** and
- **posteriorly**, up to the **apex of the petrous temporal bone**.

It is about 2 cm long, and 1 cm wide.

### Relations

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**Structures outside the sinus:**

**Superiorly:** Optic tract, optic chiasma

**Inferiorly-** foramen lacerum

**Medially-** **pituitary gland** and **sphenoidal air sinus**

**Laterally:** temporal lobe

**anteriorly:** superior orbital fissure

**posteriorly:** petrous temporal bone

**Structures in the Lateral Wall of the Sinus, from above Downwards**

- Oculomotor nerve
- Trochlear nerve
- Ophthalmic nerve.
- Maxillary nerve.

**Structures Passing through *the Centre of the Sinus***

- ***Internal carotid artery***
- **abducent nerve,**

### Tributaries or Incoming Channels

**From the orbit:**

- The superior ophthalmic vein;
- inferior ophthalmic vein
- the **central vein of the retina**

**From the brain:**

- **Superficial middle cerebral vein**



From *the meninges*:

- Sphenoparietal sinus
- middle meningeal vein

### Draining Channels or Communications

The cavernous sinus drains into-

- transverse sinus, internal jugular vein , pterygoid plexus of veins, facial vein.
- The right and left cavernous sinuses communicate with each other through the anterior and posterior inter cavernous sinuses

All these communications are valveless, and blood can flow through them in either direction.

## CLINICAL ANATOMY

### Thrombosis of the cavernous sinus

It may be caused by spreading of infection from face, nasal cavities and paranasal air sinuses.

This gives rise to the following symptoms.

- Severe pain in the eye and forehead
- involvement of the third, fourth and sixth cranial nerves resulting in paralysis of the muscles supplied.
- Marked oedema of the eyelids
- Exophthalmos.

### Pulsating exophthalmos.

- A communication between the cavernous sinus and the internal carotid artery may occur due to head injury.
- When this happens arterial blood rush into the cavernous sinus and creates force into connecting veins so
  - the eyeball comes out and pulsates with each heart beat. It is called the pulsating exophthalmos.
  - Orbital and conjunctival edema occurs

## PAROTID GLAND

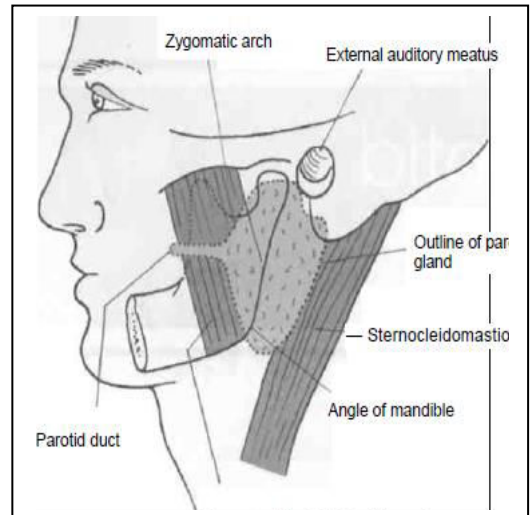
- The parotid is **the largest of the salivary glands**.
- It weighs about **15 g**.
- It is situated **below the external acoustic meatus**, between the ramus of the mandible and the sternocleidomastoid.

### Parotid Capsule

The investing layer of the deep cervical fascia forms a capsule for the gland.

### External Features

- The gland resembles a **three sided pyramid**.
- The apex is directed downwards.
- The gland has **four surfaces**
  - (1) Superior (base)
  - (2) Superficial;
  - (3) anteromedial; and
  - (4) posteromedial.



The surfaces are separated by three borders: (1) Anterior; (2) posterior; (3) medial.

## SURFACES:

The **superficial surface** is the largest of the four surfaces. It is covered with

- Skin;
- superficial fascia
- parotid fascia

The **anteromedial surface** is related to:

- masseter;
- posterior border of the ramus of the mandible;
- medial pterygoid

posteromedial surface is related to:

- **mastoid process**, with the sternocleidomastoid

### Borders:

The **anterior border** separates the superficial surface from the anteromedial surface.

The **posterior border** separates the superficial surface from the posteromedial surface.

**Medial border** seperates anteromedial surface with posteromedial surface

### ***Parotid Duct***

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- It is thick walled and is **about 5 cm long**.
- It emerges from the **anterior border of the gland**.
- It **opens into the mouth opposite the upper second molar tooth**.

### ***Blood Supply***

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- The parotid gland is supplied by the **external carotid artery and its branches**.
- **The veins drain into the external jugular vein**.

### ***Nerve Supply***

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**Parasympathetic and sensory supply by**

- **auriculotemporal nerve**.

**Sympathetic nerve**

- Derived from the **plexus around the external carotid artery**.

### ***Lymphatic Drainage***

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- **parotid nodes**

## **Clinical anatomy of parotid gland**

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**Parotid swellings** are **very painful** due to the unyielding nature of the parotid fascia.

**Mumps** is an **infectious disease of the salivary glands** (usually the parotid) caused by a specific virus.

**Parotid abscess** may be caused by **spread of infection from the mouth cavity**.

**Parotidectomy** - surgical removal of the parotid gland

**Stones or calculi** may form in the parotid duct and parotid gland. They block the secretion by gland.

### **Frey's syndrome or auriculotemporal nerve syndrome**

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– when person eats, same side cheek becomes red, hot and painful due to communication of parasympathetic with sensory fibers.

**Mixed parotid tumour** is a **slowly growing painless tumour**.

**Malignant change of such a tumour also occurs**

- It is indicated by pain, rapid growth, involvement of the facial nerve, and enlargement of cervical lymph nodes.

# TEMPOROMANDIBULAR JOINT

This is a synovial joint of the condylar variety

## Articular Surfaces

- mandibular fossa of the temporal bone:
- the head of the mandible.

## Ligaments related to the joint

**Fibrous capsule-** It enclose the joint cavity

**The lateral or temporomandibular ligament –**

- attached above articular tubercle on temporal bone and below with neck of mandible
- strengthens the lateral aspect of capsule

**The sphenomandibular ligament**

- attached above with sphenoid bone and below with lingula of mandible.

**The stylomandibular ligament**

- attached above with styloid process and below with angle of mandible

## Articular Disc

The *articular disc* is an oval fibrous plate that divides the joint into an upper and a lower compartments.

## RELATIONS OF TEMPOROMANDIBULAR JOINT

### **Lateral**

- Skin and fasciae

### **Medial:**

- **The tympanic plate**

### **Anterior:**

- **Lateral pterygoid muscle**

### **Posterior**

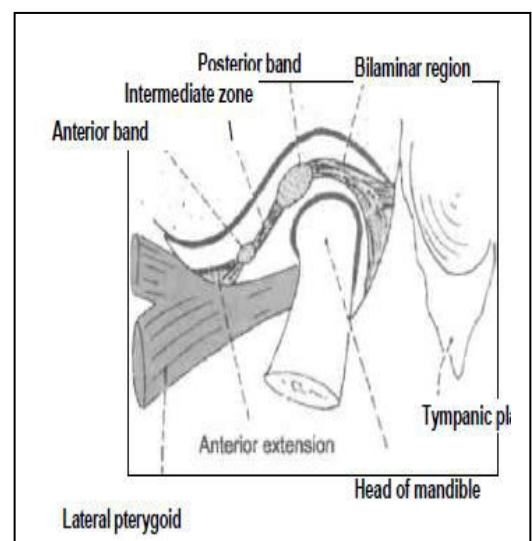
- the external auditory meatus;

### **Superior**

- **Middle cranial fossa,**

### **Inferior:**

- Maxillary artery and vein



## Blood Supply

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- **Branches from superficial temporal and maxillary arteries.**
- Veins follow the arteries.

## Nerve Supply

- **Auriculotemporal nerve and masseteric nerve**

## Muscles Producing Movements at TM Joint

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### Depression

- **Depression** is brought about mainly by the **lateral pterygoid**.
- The digastric, geniohyoid and mylohyoid muscles also help.
- **It is also done passively by gravity.**

### Elevation

- **Elevation** is brought about by the **masseter, the temporalis, and the medial pterygoid muscles of both sides.**
- These are antigravity muscles.

**Protrusion** is done by the **lateral and medial pterygoids.**

**Retraction** is produced by the **posterior fibres of the temporalis.**

**Lateral or side to side movements,**

- **By lateral pterygoid and medial pterygoid** muscles.

## CLINICAL ANATOMY

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### **1. Dislocation of mandible**

- **During excessive opening of the mouth** the head of the mandible of **one or both sides** may slip anteriorly.

### **2. Derangement of the articular disc**

- May result from any injury.
- This gives **rise to pain during movements of the jaw.**

**3. In operations** on the joint, the seventh nerve should be preserved with care.

## OTIC GANGLION

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### *Introduction*

- **it is a peripheral parasympathetic ganglion**
- It is related to the mandibular nerve, but functionally it is a part of the glossopharyngeal nerve

### *Size and Situation*

It is 2 to 3 mm in size, and is situated in the infratemporal fossa just below foramen ovale.

### *Connections and Branches*

- **The motor or parasympathetic root is formed by the lesser petrosal nerve.**
  - The **preganglionic fibres** are derived from the **inferior salivary nucleus** - the **ninth nerve**, its tympanic branch, the tympanic plexus -**the lesser petrosal nerve to reach the ganglion**
  - **Postganglionic** - pass through the **auriculotemporal nerve** to the parotid gland.
- The **sympathetic root** is derived from the **plexus on the middle meningeal artery**.
  - It contains postganglionic fibres arising in the **superior cervical ganglion**.
  - The fibres pass through the ganglion without relay and **reach the parotid gland** via the **auriculotemporal nerve**.
- The *sensory root* comes from the **auriculotemporal nerve** and is sensory to the parotid gland.

**Other fibres passing through the ganglion are as follows.**

- **nerve to medial pterygoid**
- **chorda tympani**

## NASAL SEPTUM

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The *nasal septum* is **median osseocartilaginous** partition between the two halves of the nasal cavity.

- On each side, it is covered by **mucous membrane**.
- It forms the **medial wall of both nasal cavities**.

The **bony part** is formed almost entirely by

- **vomer**, and
- **perpendicular plate of the ethmoid**.

The **cartilaginous part** is formed by

- **septal cartilage**, and

The lower margin of the septum is called the **columella**.

The septum has

- **Four borders**-superior, inferior, anterior and posterior
- **Two surfaces**- Right and left.

**Arterial Supply**

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- **Anterosuperior part** is supplied by the anterior ethmoidal artery
- **Anteroinferior part**: by the superior labial artery branch of facial artery.
- **Posterosuperior part**: by the posterior ethmoidal artery.
- **Posteroinferior part**: is supplied by the sphenopalatine artery.

**What is Kiesselbach's plexus?**

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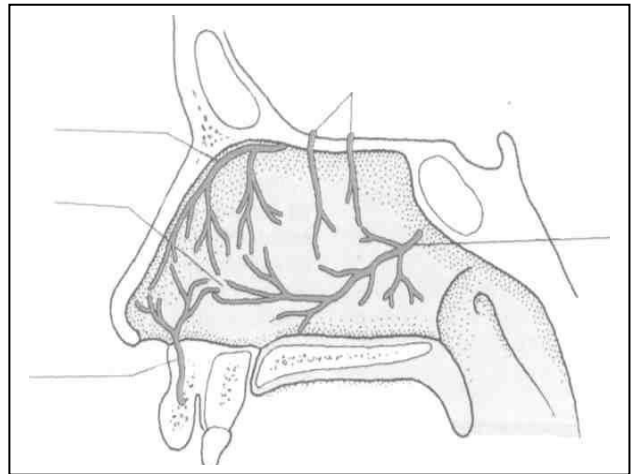
The **anteroinferior part** of the **septum** contains anastomoses between **superior labial branch** of the facial artery, **branch of sphenopalatine artery**, and of **anterior ethmoidal artery**.

- These form a large capillary network called the **Kiesselbach's plexus**.
- This is a common site of bleeding from the nose also known as epistaxis
- It is known as **Little's area**.

**Venous Drainage**

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- The veins form a plexus.
- The plexus drains into **facial vein**, **sphenopalatine vein**, **pterygoid venous plexus**.



### Nerve Supply

**General sensory nerves**, arising from **trigeminal nerve**, are distributed to whole of the septum

- anterior ethmoidal nerve.
- anterior superior alveolar nerve
- nasopalatine nerve

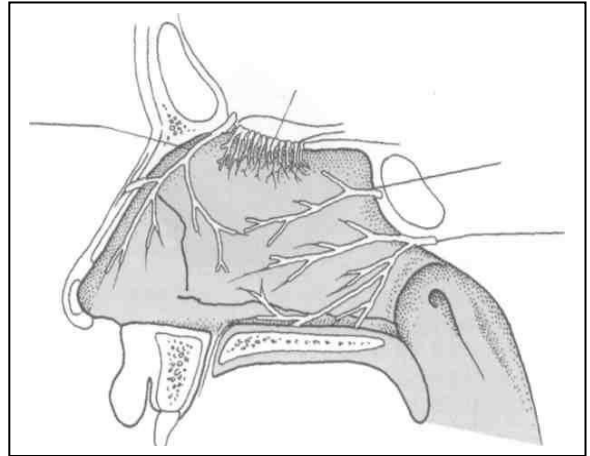
They carry sensations of pain, touch and temperature.

**Olfactory nerves** carry smell sensation.

### Lymphatic Drainage

**Anterior half** to the **submandibular nodes**.

**Posterior half** to the **retropharyngeal and deep cervical nodes**.



### CLINICAL ANATOMY

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- **Little's area on the septum** is a common site of **bleeding from the nose** or **epistaxis**.
- **Pathological deviation of the nasal septum [DNS]**
  - It is responsible for repeated attacks of common cold, allergic rhinitis.
  - **It requires surgical correction**
- Rhinoscopy-
  - Examination of nasal cavity is known as rhinoscopy.



## LATERAL WALL OF NOSE

---

The lateral wall of the nose is **irregular**.

The skeleton of the lateral wall is partly bony and partly cartilaginous.

The **bony part** is formed by following bones:

- (1) Nasal;
- (2) frontal process of maxilla;
- (3) lacrimal;
- (4) ethmoid with superior and middle conchae;
- (5) inferior nasal concha;

The **cartilaginous part** is formed by:

- Superior nasal cartilage;
- Inferior nasal cartilage; and
- **3 or 4 small cartilages of the ala.**

**Conchae and Meatuses.**

- The *inferior concha* is an independent bone.
- The *middle concha* and The *superior concha* is a projection from the medial surface of the ethmoidal labyrinth.

The **inferior meatus** lies **below the inferior concha**

- **nasolacrimal duct opens into it**

The **middle meatus** lies **below the middle concha**.

It is having **ethmoidal bulla, hiatus semilunaris.**

It is having opening of

- Frontal air sinus
- Maxillary air sinus
- Anterior ethmoidal air sinus
- Middle ethmoidal air sinus

The **superior meatus** lies below the **superior concha**.

It receives the *openings of the **posterior ethmoidal air sinuses.***

**Arterial Supply of Lateral Wall**

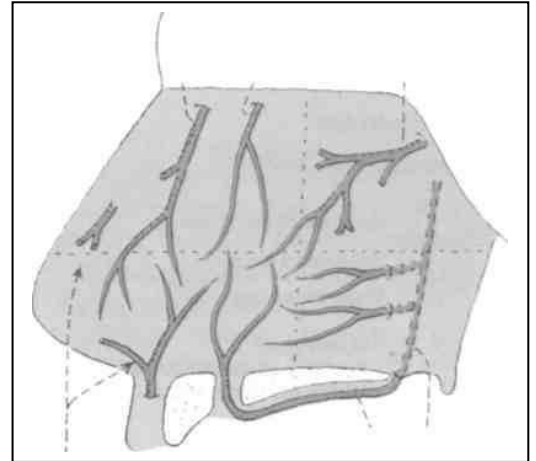
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***Anterosuperior quadrant*** is supplied by the **anterior ethmoidal artery**

***Anteroinferior quadrant***, is supplied by branches from the **facial and greater palatine arteries**

The ***posterosuperior quadrant***, is supplied by the **sphenopalatine artery**.

The ***posteroinferior quadrant*** is supplied by branches from the **greater palatine artery**



---

### Venous Drainage

The veins form a plexus which drain into **facial vein; pharyngeal plexus of veins; pterygoid plexus of veins.**

---

### Nerve Supply

**General sensory nerves** from the **branches of trigeminal nerve** are distributed to whole of the lateral wall:

- **anterior ethmoidal nerve**
- **anterior superior alveolar nerve**
- **greater palatine nerve**

***olfactory nerve*** for smell sensation

---

### Lymphatic Drainage

- **submandibular nodes,**
- **Retropharyngeal and upper deep cervical nodes.**

---

### CLINICAL ANATOMY

- **Common cold or rhinitis** is the commonest infection of the nose.
- The paranasal air sinuses **may get infected from the nose.** Maxillary sinusitis is the commonest of such infections.
- **Hypertrophy of the mucosa over the inferior nasal concha** is a common feature of allergic rhinitis, which is characterized by sneezing, nasal blockage and excessive watery discharge from the nose.

## MAXILLARY SINUS

---

The maxillary sinus lies in the **body of the maxilla** and is the **largest** of all the paranasal sinuses.

**It is pyramidal in shape.**

- **Base** directed medially towards the lateral wall of the nose.
- **Apex** directed laterally in the zygomatic process of the maxilla.
- **Roof** is formed by the floor of orbit.
- **Floor** is formed by the alveolar process of the maxilla,
  - The floor is marked by elevations produced by the roots of the upper molar and premolar teeth

**It opens into the middle meatus of the nose in the lower part of the hiatus semilunaris**

**The size of the sinus is variable.** Average measurements are: height, 3.5 cm; width, 2.5 cm and anteroposterior depth- 3.5 cm

### CLINICAL ANATOMY

---

**Infection of a sinus** is known as **sinusitis**.

- It causes headache and discharge from the nose.
- The maxillary sinus is most commonly involved.

**Carcinoma of the maxillary sinus arises from the mucosal lining.**

Symptoms depend on the **direction of growth**.

## FACIAL NERVE

---

This is the seventh cranial nerve.

**The fiber of nerve arise from four nuclei situated in the lower pons.**

- Motor nucleus
- Superior salivatory nucleus
- Lacrimate nucleus
- Nucleus of tractus solitarius

### Course and relation

The facial nerve attached to the brainstem by two roots motor and sensory

Reach the internal acoustic meatus

The first part is directed laterally

Second part runs backward in relation to the medial wall of middle ear

Third part is directed vertical downward

Facial nerve leaves skull by passing through stylomastoid foramen

- It enters the **posteromedial surface of the parotid gland**, Behind the neck of the mandible it divides into its **five terminal branches**

### **Branches and Distribution**

Within the facial canal:

- Greater petrosal nerve
- Nerve to the stapedius;
- Chorda tympani

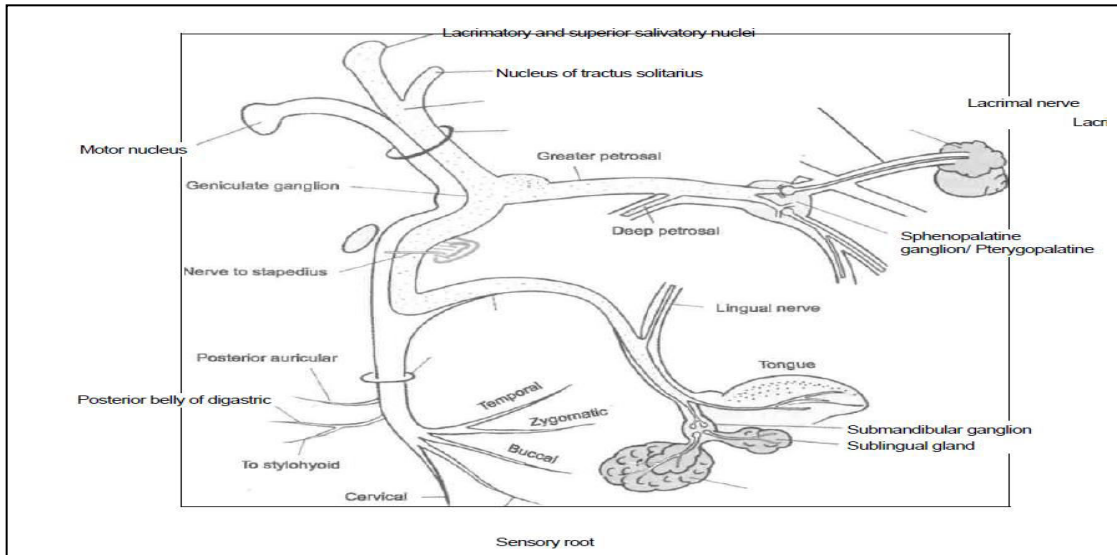
At the **exit from the stylomastoid foramen**:

- Posterior auricular;
- digastric; and

- stylohyoid.

### Terminal branches within the parotid gland:

- Temporal;
- Zygomatic; Buccal
- Marginal mandibular; Cervical.



### Bell's palsy. [Facial palsy]

In **infranuclear lesions** of the facial nerve, known as **Bell's palsy**.

- The whole of the face of the **same side gets paralyzed**.
- The face becomes **asymmetrical and is deviated to the normal side**.
- The affected side is **motionless**.
- **Wrinkles disappear** from the forehead.
- The **eye cannot be closed**.
- Any attempt to smile deviates the mouth to the normal side.
- **During mastication, food accumulates between the teeth and the cheek**.
- Articulation of labials is impaired.

In **supranuclear lesions** of the facial nerve;

- only the lower part of the opposite side of face is paralysed.
- The upper part with the **frontalis and orbicularis oculi** have **bilateral representation in the cerebral cortex** so do not affected

## LACRIMAL APPARATUS

---

The structures related with **secretion and drainage of the lacrimal fluid** combinely known as the lacrimal apparatus.

It is made up of the **following parts:**

- ❖ Lacrimal gland and its ducts.
- ❖ Conjunctival sac.
- ❖ Lacrimal puncta and lacrimal canaliculi.
- ❖ Lacrimal sac.
- ❖ Nasolacrimal duct.

### Lacrimal Gland

- It is a **serous gland** situated in the **lacrimal fossa** on the anterolateral part of the roof of the bony orbit.
- The gland is '**J**' shaped,
- **10-12 lacrimal ducts** open into the **conjunctival sac**
- The gland is supplied by the **lacrimal branch of the ophthalmic artery** and by the **lacrimal nerve**.
- The **lacrimal fluid** secreted by the lacrimal gland flows into the conjunctival sac
- it lubricates the front of the eye and the deep surface of the lids.

### Conjunctival Sac

- The potential space between the palpebral and bulbar part of conjunctiva is the conjunctival sac.

### Lacrimal Puncta and Canaliculi

- Each lacrimal canaliculus **begins at the lacrimal punctum**, and is 10 mm long.
- It has a vertical part and a horizontal part.
- **Both canaliculi open into the lacrimal sac**

### Lacrimal Sac

- It is membranous sac situated in the **lacrimal groove**
- Its **upper end is blind**. The lower end is continuous with the nasolacrimal duct.

### Nasolacrimal Duct

- It is a **membranous passage**
- It begins at the **lower end of the lacrimal sac**, runs downwards, backwards and laterally, and **opens into the inferior meatus of the nose**

### Clinical anatomy

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- In **Bell's palsy** , lacrimal gland fail to secrete lacrimal fluid
- **Inflammation of lacrimal sac** is known as **dacrocystitis**
- **Epiphora** – overflow of tears from conjunctival sac to cheeks. It occurs due to hyperlacrimation or blockage of lacrimal passage

## THYROID GLAND

---

The thyroid is an endocrine gland, situated in the lower part of the front and sides of the neck.

- The gland consists of right and left lobes that are joined to each other by the *isthmus*

### Each lobe measures

- about 5 cm x 2.5 cm x 2.5 cm,
- and the isthmus 1.2 cm x 1.2 cm.

On an average the gland weighs about 25 g.

### Capsules of Thyroid

1. The **true capsule** is the peripheral condensation of the connective tissue of the gland.
2. The **false capsule** is derived from the pretracheal layer of the deep cervical fascia

### Relations

The lobes are conical in shape having:

- Apex,
- Base
- Three surfaces, lateral, medial and posterior
- Two borders, anterior and posterior.

The **apex** is directed **upwards**

The **base** is on level with the 4th or 5th tracheal ring.

The **lateral or superficial surface is convex**, and is covered by:

- sternohyoid;
- superior belly of the omohyoid;
- sternothyroid; and
- sternocleidomastoid

**Medial surface** is related to- **trachea and oesophagus;**

**Posterior surface** is related to the **carotid sheath;**

**Isthmus** connects the **lower parts of the two lobes.**

## Blood Supply

---

The thyroid gland is supplied by the **superior and inferior thyroid arteries.**

The **superior thyroid artery** is the branch of the external carotid artery



- It runs downwards and forwards
- It reach the **upper pole of the lobe**.
- Here it **divides into anterior and posterior branches**.
- The **anterior branch**
  - continues along the **upper border of the isthmus**
  - It **anastomose with anterior branch of the opposite side**.
- The **posterior branch** descends on the posterior border of the lobe
  - It **anastomoses with the ascending branch of the inferior thyroid artery**

The ***inferior thyroid artery*** is a branch of the thyrocervical trunk  
It reach the **lower pole of the gland**.

- The artery divides into **4 to 5 glandular branches**.
- One ***ascending branch*** **anastomoses** with the posterior branch of the superior thyroid artery.
- Sometimes (in 3% of individuals), the thyroid is also supplied by the ***lowest thyroid artery***.

### Venous Drainage

The thyroid is drained by the superior, middle and inferior thyroid veins.

### Lymphatic Drainage

- **deep cervical nodes**

## CLINICAL ANATOMY

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Any swelling of the thyroid gland known as **goitre**

Removal of the thyroid is known as **thyroidectomy**

- It may be necessary in hyperthyroidism or thyrotoxicosis

In **partial thyroidectomy**, the posterior parts of both lobes are left behind.

- This **avoids the risk**
  - Simultaneous removal of the parathyroid.

**Hypothyroidism** causes **cretinism in infants and myxoedema in adults**.

**Benign tumours of the gland** may **compress neighbouring structures**, like the carotid sheath, the trachea

**Malignant growths** invade and damage neighbouring structures.

## MIDDLE EAR

---

The middle ear is also called the **tympanic cavity**.

- The middle ear is a narrow air filled space situated in the petrous part of the temporal bone
- between the external ear and the internal ear

### Shape and Size

The middle ear is shaped like a **cube**

### *Boundaries*

#### The Roof or Tegmental Wall

- The roof separates the middle ear from the middle cranial fossa.
- It is formed by a **thin plate of bone** called the **tegmen tympani**

#### The Floor or Jugular Wall

- The floor is formed by a **thin plate of bone**
- Which separates the middle ear from the superior bulb of the **internal jugular vein**.

#### The Anterior Wall

The anterior wall is **narrow** due to the approximation of the medial and lateral walls  
It has the opening of the **auditory tube**

#### Posterior or Mastoid Wall

There is an opening or **aditus**

- through which communication with the **mastoid antrum**

#### *The Lateral or Membranous Wall*

- The lateral wall separates the middle ear from the external ear.
- It is formed Mainly by the **tympanic membrane**

#### *The Medial or Labyrinthine Wall*

The medial wall separates the middle ear from the internal ear.

### Clinical anatomy

**Otitis Media-** Inflammation of middle ear is known as **otitis media**

**Throat infections commonly spread to the middle ear through the auditory tube and cause otitis media.**

Otitis media is **more common in children than in adults**

## **NERVE SUPPLY AND LYMPHATIC DRAINAGE OF TONGUE**

---

### **Nerve supply of tongue**

It is two types

#### **Motor supply**

- All the muscles of tongue **except palatoglossus** are supplied by **hypoglossal nerve**.
- **Palatoglossus** is supplied by **cranial root of accessory nerve** via pharyngeal plexus.

#### **Sensory supply**

##### **Anterior 2/3<sup>rd</sup> of the tongue**

- General sensation – by **lingual nerve**
- Taste sensation – by **chorda tympani nerve**

##### **Posterior 1/3<sup>rd</sup> of the tongue**

- General sensation and taste sensation by **glosopharyngeal nerve**

##### **Posterior most part of the tongue**

- General sensation and taste sensation by **vegus nerve**

### **Lymphatic drainage of tongue**

#### **Apical portion of tongue**

- It drains into **submental** group of lymphnodes

#### **Marginal portions of anterior 2/3<sup>rd</sup> of the tongue**

- On each side drains into the **submandibular group** of lymph nodes

#### **Cenral portion of anterior 2/3<sup>rd</sup> of the tongue**

- Drains into **deep cervical group** of lymph nodes

#### **Posterior 1/3<sup>rd</sup> and root of tongue**

- Bilaterally drains into the **deep cervical group** of lymph nodes

### **Applied anatomy**

#### **Cancer on posterior part of tongue**

- Spreads through lymphatics to both the sides of lymphnodes.
- It occurs due to huge communication with two sides.

- so poor prognosis

### Cancer on anterior side of tongue

- Does not spread to opposite side of lymphnodes till the late stage.
- Better prognosis than posterior side carcinoma.

## PALATINE TONSIL

---

Palatine Tonsils are **lymphoid mass of tissue** situated in **tonsillar fossa** between palatoglossal and palatopharyngeal arch.

### External features

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- **Anterior border**- related to palatoglossal arch
- **Posterior border**- related to palatopharyngeal arch
- **Upper pole**- related to soft palate
- **Lower pole** – related to tongue
- **Medial surface**-
  - It is free and towards oropharynx.
  - It is having 12 to 15 **tonsillar crypts**.
  - The **largest crypt** is known as **crypta magna** or intertonsillar cleft.
- **Lateral surface**- It is covered by capsule.

The structures related to lateral surface forms tonsillar bed. It is formed by...

- Pharyngobasilar fascia
- Buccopharyngeal fascia
- Superior constrictor muscle
- Styloglossus muscle
- Glossopharyngeal nerve
- Facial artery

**Loose areolar tissue** between tonsillar capsule and tonsillar bed is called as **peritonsillar space**.

### **Blood supply of tonsil**

- **Tonsilar branch** of facial artery [ main artery]
- Branches from **dorsal lingual artery, ascending pharyngeal artery and greater palatine artery**.

### **Nerve supply**

- **Glossopharyngeal nerve**

- Lesser palatine nerves

### Venous drainage

- By **paratonsillar vein** into pharyngeal plexus of vein.

### Lymphatic drainage

- Into **deep cervical group** of lymphnodes

## Applied anatomy

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- **Tonsillitis** – Inflammation of tonsil is known as tonsillitis.
  - It is mainly due to viral or bacterial infection. It is more common in children.
- **Quensy- [peritonsillar abscess]** – collection of pus in the peritonsillar space.
- **Tonsillectomy** – Removal of tonsil is known as tonsillectomy.
  - bleeding after tonsillectomy is common. It occurs mainly due to damage to **paratonsillar vein**.

## SOFT PALATE

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The soft palate is **movable muscular fold** which is attached to posterior border of hard palate **separating nasopharynx from oropharynx**.

### External features

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**Anterior surface**- is concave and towards oral cavity

**Posterior surface** – is convex and towards nasal cavity

**Superior border** is attached to the posterior border of hard palate

**Inferior border** is free.

- small tongue like projection is hanging down from middle is called **uvula**.

### Structure

---

It is made up of fold of mucous membrane enclosing five pairs of muscles.

### Muscles of soft palate

**Tensor veli palatine** – tightens the soft palate

**Levator veli palatine**- elevates the soft palate

**Palatoglossus**- pulls up the root of tongue

**Palatopharyngeus**- raise the walls of pharynx during swallowing.

**Musculus uvulae**- pulls the uvula

### Nerve supply

- All the muscles of soft palate are supplied by **cranial root of accessory nerve** via **pharyngeal plexus** [ comes through vagus nerve] **except tensor veli palatini which is supplied by mandibular nerve.**
- **Sensory supply** by branches of **maxillary nerve** and **glossopharyngeal nerve**

### Arterial supply

- **Ascending palatine A.** branch of facial artery
- **Lesser palatine A.** branch from maxillary A.
- **Palatine branches** of ascending pharyngeal A.

### Venous drainage

- **Pharyngeal venous plexus** and **pterygoid venous plexus**

### Lymphatic drainage

- **Retropharyngeal** and **upper deep cervical group** of lymph nodes.

### Function of soft palate

- Separate oropharynx from nasopharynx during swallowing so that food does not enter the nose
- To modify the quality of voice
- Protect during sneezing and coughing

### Applied anatomy

Paralysis of the soft palate [due to lesion of vagus nerve] results in...

- Nasal regurgitation of food and liquid
- Nasal twang in voice
- Deviation of uvula to normal side

## MANDIBULAR NERVE

---

It is the largest Division of trigeminal nerve

It is mix variety of nerve. Sensory and motor both.

### Course

It starts in **middle cranial fossa**

It **comes out** from cranial cavity through **foramen ovale**

After coming out **Main trunk divides** into **anterior and posterior trunk**

### Branches

### From Main trunk

1. **Meningeal branch** - supplies **dura mater**
2. **Nerve to medial pterygoid**- supplies **medial pterygoid muscle**.
  - its fibers pass from otic ganglion and supplies tensor veli palatini

### From anterior trunk

1. **Massetric nerve**- supply **masseter muscle** and temporomandibular joint
2. **Nerve to lateral pterygoid**- supply **lateral pterygoid muscle**
3. **Deep temporal nerve**- supply **temporalis muscle**
4. **Buccal nerve** it is the **sensory branch**

### From posterior trunk [ ALI ]

- 1 **Auriculotemporal nerve**-
  - Supply auricle and temporal part of skin
  - Also supply **parotid gland** and **temporomandibular joint**
2. **Lingual nerve**
  - **sensory** for **anterior 2/3rd of tongue** [taking general sensations]
3. **Inferior alveolar nerve**
  - it enters the **mandibular foramen** runs in mandibular canal
  - It supplying mylohyoid muscle, lower teeth and gums
  - Comes out as **mental nerve** from mental foramen

## Clinical

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### Referred pain

- In case of cancer of tongue pain radiates to the ear and temporal fossa along the distribution of auriculotemporal nerve

### Mandibular neuralgia

- **Pain** along the distribution of mandibular nerve

# Brain



## INTERPEDUNCULAR FOSSA

---

- It is situated at base of brain
- It is rhomboid shaped fossa

### Boundry

- **Anteriorly** by **optic chiasma and optic tracts**
- **Posteriorly** by **pons**
- On **each side** by **crus cerebri**

### Content of fossa

1. **Tuber cinerium** which is raised area of grey matter
2. Two small spherical boddies known as **mammillary bodies**
3. A **narrow stalk** which connects pituitary gland with **tuber cinerium** is called as **infundibulum**
4. **Posterior perforated substance**
5. **Oculomotor nerve**

## INFERIOR CEREBELLAR PEDUNCLE

---

The afferent and efferent fiber of cerebellum are grouped together on each side into three types of bundle called cerebellar peduncles

- **Superior** cerebellar peduncles
- **Middle** cerebellar peduncles
- **Inferior** cerebellar peduncles

### **Inferior cerebellar peduncles**

- It is formed on the **posteriolateral aspect** of the upper half of medulla oblongata.

### **It contains**

#### **Afferent fibers [ORSVC]**

- **Olivocerebeller** fibers from olivary nucleus
- **Reticulocerebeller** fibers from reticular nucleus
- **Spinocerebellar** fibers from spinal cord to cerebellum
- **Vestibule cerebellar** fibers from vestibular nerve
- **Cuneocerebeller** fibers from cuneate nucleus

### Efferent fibers [ORV]

- Cerebello olivary fibers
- Cerebello reticular fibers
- Cerebello vestibular fibers

## INTERNAL CAPSULE

---

Internal capsule is compact bundle of projection fiber

In horizontal section of cerebral hemisphere it appear as “v” shaped.

### Situation

- **Medially**—thalamus and caudate nucleus
- **Laterally**—lentiform nucleus

### Parts of internal capsule

It is divided into **five parts**

- **Anterior limb**—lies between thalamus and lentiform nucleus
- **Posterior limb**—lies between thalamus and lentiform nucleus
- **Genu**—it is between anterior limb and posterior limb
- **Retro-lentiform part**—lies behind the lentiform nucleus
- **Sub-lentiform part**—lies below lentiform nucleus

### Fibers of the internal capsule

#### Motor fibers

#### Pyramidal fibers

Which are two types

- **Corticospinal fibers** for head and neck—passing from genu
- **Corticospinal fibers** for upper limb, trunk, lower limb passing from posterior limb and situated from anterior to posterior

**Extrapyramidal fibers occupying position near the corticospinal fibers.**

#### Sensory fibers

They are thalamo-cortical fibers

- **Anterior thalamic radiation** from anterior limb. Connecting thalamus to frontal lobe
- **Superior thalamic radiation** from genu and posterior limb connecting thalamus to frontal and parital lobe
- **Posterior thalamic radiation** from retrolentiform part. connect the LGB to occipital lobe[**optic radiation**]
- **Inferior thalamic radiation** from sublentiform part. Connect the MGB to temporal lobe[**auditory radiation**]

### Arterial supply

Branches from middle cerebral ,anterior cerebral, internal carotid, posterior communicating and posterior cerebral artery.

### Clinical anatomy

#### Damage to internal capsule-

- It occurs due to **haemorrhage**.
- Haemorrhage occurs due to **damage of charcot's** artery which supply posterior limb of internal capsule.
- **It leads to loss of sensation and paralysis of the opposite half of the body.**

## THIRD VENTRICLE

---

It is a slit like cavity situated between two thalami

### Boundries

#### **Anterior wall –**

- Anterior commissure
- Lamina terminalis

#### **Floor**

- Optic chiasma
- Tuber cinerium and infundibulum
- Mammillary bodies
- Posterior perforated substance
- Tegmentum of midbrain

#### **Posterior wall**

- Pineal gland
- Posterior commissure

#### **Roof**

- By ependyma [telachoroidia of 3<sup>rd</sup> ventricle]

#### **Lateral wall**

- Larger upper part of lateral surface by **medial surface of thalamus**
- Smaller lower part of the **lateral wall is by hypothalamus**

#### **Communication**

- With lateral ventricle by **intraventricular foramen[of montro]**
- With 4<sup>th</sup> ventricle by **cerebral aqueduct[of sylvius]**

**It receives CSF from lateral ventricle transport it into to fourth vent.**

**Recesses of the ventricle-** Cavity of 3<sup>rd</sup> ventricle **extend into surrounding structure as pocket like prostration is called as recess.**

They are as follow

- Anterior recess
- optic recess
- infundibular recess
- suprapineal recess
- pineal recess

### Clinical anatomy

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**hydrocephalus** or increased intra-cranial pressure

- 3<sup>rd</sup> ventricle is easily **obstructed** by local brain tumor or congenital defect
- **Obstruction** result in accumulation of CSF
- **Intracranial pressure raised** in adults and **hydrocephalus** in children

## 4<sup>TH</sup> VENTRICLE

---

It is tent like cavity situated in posterior cranial fossa

It is situated in **front of cerebellum** and **behind the pons and upper part of medulla oblongata**

### Boundaries

#### Lateral wall on each side

- **Inferolaterally** by inferior cerebellar peduncle
- **Suprolaterally** by superior cerebellar peduncle

#### Roof [posterior wall]

- **Upper part** by convergence of two superior cerebellar peduncles and thin sheet of white matter known as **superior medullary velum**
- **Lower part** by inferior medullary velum

## FLOOR OF 4<sup>TH</sup> VENTRICLE

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### Floor

It is formed by **posterior surface of pons and upper part of medulla**.

It is **rhomboid** in shape

- Entire floor is divided into two halves by **median sulcus**
- **On side of median sulcus** there is elevation called **median eminence**
- Median eminence having oval swelling known as **facial colliculus**
- Lateral to median eminence there is **sulcus limitans**
- **Stria medullaris** divide the floor into upper and lower part

- In the lower part in the lower medullary part
  - **Hypoglossal triangle** above
  - **Vegal triangle** below
- Area between vegal triangle and gracile tubercle is known as **area postrema**.

### Angle of 4<sup>th</sup> ventricle

- **Four** angle –superior, inferior, and two lateral angle

### Recesses of fourth ventricle

- **Two lateral recess**
- **Two lateral dorsal recess**
- **One median dorsal recess**

### Openings in the fourth ventricle

There are five openings

- Central openings in the roof-**foramen magendie**
- Two lateral opening in the roof-**foramen luschka**
- **Central canal** of medulla oblongata
- **Central aqueduct** of midbrain

### Clinical anatomy

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#### Medulloblastoma-

- Most **common tumor** in the region of 4<sup>th</sup> ventricle
- It is **highly malignant**.
- It do compression on vital centres located in the floor and cardiac arrhythmia, irregular respiration and vasomotor disturbance occure

#### Internal hydrocephalus

- It occur due to **blockage of opening of 4<sup>th</sup> ventricle**.
- **CSF accumulate and produce internal hydrocephalus**

## LATERAL MEDULLARY SYNDROME

---

- **Dorsolateral part of the medulla and inferior surface of cerebellum** is supplied by **posterior inferior cerebellar artery** [pica]
- **Thrombosis of posterior inferior cerebellar artery** affects dorso lateral aspect of medulla and inferior surface of cerebellum
- **Result in following signs and symptoms**

### Opposite side

- **Loss of pain and temperature** sensation of opposite side of trunk and limbs due to **involvement of spinothalamic tract**

### Same side

- **Loss of pain and temperature** sensation same side of **face** due to involvement of the **spinal nucleus of trigeminal nerve**
- **Paralysis of muscle of pharynx and larynx** due to involvement of **nucleus ambiguus**
- **Ataxia** due to involvement of **inferior cerebellar peduncle** and cerebellum
- **Horner's syndrome** due to involvement of **reticular formation**

## MEDIAL MEDULLARY SYNDROME

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- **Paramedian part of the medulla** is supplied by **branches of vertebral artery**
- **Thrombosis** of that branch affect paramedian aspect of medulla **result in following signs and symptoms**

### Opposite side

- **Loss of position and vibration sensation** opposite side of body due to involvement of **medial lemniscus**
- **hemiplegia**-paralysis of opposite side arm and leg due to **damage to pyramid**.

### Same side

- Same side **atrophy of the half of the tongue** due to damage of **hypoglossal nerve**.

## HEMISECTION OF THE SPINAL CORD OR BROWN SEQUARD SYNDROME

---

Effects of hemisection of spinal cord are as below

### Below the level of hemisection

#### Same side

- **Spastic paralysis** due to involvement of **pyramidal tract**
- **Loss of proprioception, vibration, fine touch** due to involvement of **dorsal columns**

#### Opposite side

- **Loss of pain and temperature** sensation due to involvement of **spinothalamic tract**.

### At the level of hemisection

#### Same side

- **Spastic paralysis** due to involvement of pyramidal tract.
- **Loss of proprioception, vibration, fine touch** due to involvement of **dorsal columns**.
- **Loss of pain and temperature** sensation due to involvement of **spinothalamic tract**.

#### Opposite side-

- **no effect on opposite side at the level of hemisection**

## CORPUS CALLOSUM

---

It is the **largest commissure** of the brain.

- It is connecting two cerebral hemispheres.
- Length: **10 cm**
- It is having **300 million fibers**

### External features

- In sagittal section of cerebrum, **it is seen as "c" shaped**
- It lies **4 cm behind** the frontal pole and **6 cm anterior to posterior pole**
- Superior aspect is convex and inferior aspect is concave

### Parts of corpus callosum



- It is divided in **4 part**
- From **before to backward**- rostrum, genu, body, splenium

### Rostrum

- It is directed downward and backward from genu
- Fiber passing from this part **connect orbital surface of two frontal lobes.**

### Genu

- It is **thick** and curved part.
- Fiber of genu connecting **anterior parts of frontal lobes**
- It forms **fork like structure known as forceps minor.**

### Body/trunk

- It is **main part** of corpus callosum
- It lies **between genu and splenium**
- Fibers of the body connect most of the **frontal lobe and anterior part of parietal lobe of two hemispheres.**

### Splenium

- It is most **posterior part** of corpus callosum.
- Fibers of splenium **connect posterior part of parietal lobes, temporal and occipital lobes of two hemisphere**
- Fibers connecting two occipital lobes **forming a fork like structure called as forceps major**

### Function of corpus callosum

- It is responsible **for transmission of information between two cerebral hemispheres**

### Applied

#### Split-brain syndrome

- If the corpus callosum is congenitally absent or surgically sectioned
- Then the person has two separate hemispheres this condition is known as **split brain syndrome.**
- In this case person learns to perform task with one hand he is unable to repeat it with other hand

## BLOOD SUPPLY TO BRAIN

---

Brain is supply by two systems of artery

1. **Vertebral system** having two vertebral artery
2. **Carotid system** having two internal carotid artery
  - These arteries of brain get **interconnected and form circle of willis**
  - It is the **base of brain** around **interpeduncular fossa**.

**Circle of willis is formed:**

- **Anteriorly** -by anterior communicating artery and anterior cerebral arteries
- **Posteriorly** -by **basilar artery** dividing into two **posterior cerebral artery**
- **Latterly on each side-** by **posterior communicating artery** which is connecting internal carotid artery with posterior cerebral artery.

**Functional significance of circle of willis**

Normally there is little or no mixing of blood stream of

1. Two vertebral artery in basilar arteries
  2. Two anterior cerebral artery in anterior communicating arteries
  3. Internal carotid and posterior cerebral arteries.
- **Therefore, right half of brain is supplied by right vertebral and right internal carotid artery.**
  - And left half of brain is supplied by left vertebral and left internal carotid arteries
  - **If one of the major arteries of circle of willis is blocked, connection provide collateral circulation.**

### Applied

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#### Aneurysms

- **Abnormal dilation** of arteries is known as aneurysms
- It occur mostly as sites where arteries join with each other
- In brain arteries it's common. **It's berry shaped** so named as **berry aneurysms**

#### Subarachnoid haemorrhage

- **If the artery rupture**, it produces haemorrhage in **Subarachnoid space**
- it produce **severe pain in head and mental confusion**

# Upper Limb

## BREAST

---

### Breast or mammary gland

- The breast lies in the superficial fascia of the pectoral region

### Extent

- Vertically extends from the **second to sixth rib**
- Horizontally it extends from **lateral border of sternum to the mid axillary line**

**Skin** covers the gland

Conical projection on skin called **Nipple**

Skin surrounding base of nipple is pigmented forms a circular area called the **areola**

- This region is rich in **modified sebaceous glands**

### Breast parenchyma

- having **tubule-alveolar arrangement**. It secretes milk.
- **It consist of 15 to 20 lobes**
- Each lobe having **alveoli** which are drained by **lactiferous duct**
- Lactiferous ducts **open into nipple**

### Stroma

- It is partly **fibrous** and **partly fatty**
- **Fibrous part** is formed by septa known as **suspensory ligaments** which connects skin with pectoral fascia
- **Fatty part forms bulk of the gland**

### Blood supply

- By internal thoracic artery
- Lateral thoracic, superior thoracic artery and branch from posterior intercostal arteries.

## LYMPHATIC DRAINAGE OF BREAST

---

- By lymph nodes and the lymphatics

### Lymph nodes

There are mainly **three groups of lymph nodes**

The **axillary group of lymph nodes**

- anterior
- posterior,
- lateral,
- central,
- and apical groups

**Internal mammary group of lymph nodes**

**Supra clavicular group, Posterior intercostal group of lymph nodes**

**Lymphatic vessels**

- **The superficial lymphatics**

Which drain the skin over the breast except nipple and areola

**Deep lymphatics**

- Drain the parenchyma of the breast. also nipple and areola

❖ **About 75% of lymph goes to axillary nodes**

❖ **20% to internal mammary group of lymph nodes**

❖ **5% into posterior intercostal nodes**

**Lymph from**

- **Anterior and posterior group goes into central and lateral groups**
- From here it goes to **apical group**
- And finally to **supra clavicular nodes**

## Clinical Of Breast

- The upper and outer quadrant of breast is a **frequent site for carcinoma**
- **Incisions of breast** are usually made **radially** to avoid injury to lactiferous ducts

**Folding of skin**

- when cancer cells infiltrate suspensory ligaments folding of skin occurs
- It leads to retraction of nipple

**peau d'orange appearance**

- **Obstruction of lymphatics** produce **oedema of skin** and orange color changing known as peau d'orange appearance

### Spreading of cancer cells occur through lymphatics

- Cancer spread to liver

### It can spread through veins also

- It spread to vertebrae and to other parts also

### Self examination of breasts

---

- Inspect symmetry of breast and nipples
  - Change in color of skin
  - Retraction of nipple is a sign of cancer
  - Any discharge from nipple
  - **Palpate** four quadrants and see for any abnormal swelling
  - **See for lymph node swelling**
- 
- X-Ray of breast is known as **mammogram**
  - **FNAC** is safe and quick method for diagnosis of lesion of breast
  - **Self examination** is the way for early diagnosis and treatment

## CLAVIPECTORAL FASCIA

---

Clavipectoral fascia is a **fibrous sheet** situated **deep to pectoralis major muscle**.

**Extent-**

**Above** - clavicle

**Below** - axillary fascia

**Attachments**

**Medially**- attached with 1<sup>st</sup> rib

**Laterally**- coracoids process

**Above**- attached with lips of subclavian groove of clavicle. Here it splits to enclose **subclavius muscle**.

**Below**- It splits to **enclose pectoralis minor muscle**

- It continues downward as suspensory ligament of axilla which is attached to dome of axillary fascia.

**It helps to keep it pulled up.**

### **Functional significance**

- Act as a suspensory ligament of axilla to maintain its concavity.

### **Structures piercing clavipectoral fascia**

- Lateral pectoral Nerve
- Thoracoacromial artery
- Cephalic vein
- Deep lymphatics of breast going towards apical group of axillary lymphnodes.

## **AXILLA BOUNDARY AND CONTENT**

---

It is a **pyramidal space** situated between the upper part of arm and the chest wall

**It has**

- Apex, a base, four walls - anterior, posterior, medial and lateral

### **Apex**

It is directed upwards **towards the root of neck**

It's not pointed. It's a triangular interval

### **Bounded by**

- Anteriorly by clavicle
- Posteriorly by scapula
- Medially by a rib

### **Base**

It's directed downwards

- Formed by **skin, superficial and axillary fascia**

### **Anterior wall**

- Pectoralis major
- Clavipectoral fascia
- Pectoralis minor

### Posterior wall

- Subscapularis
- Teres major
- Latissimus dorsi

### Medial wall

- Upper four ribs with their intercostal muscles
- Serratus anterior muscle

### Lateral wall

It is very narrow. **Anterior and posterior walls converge on it**

#### It is formed by

- Bicipital groove, upper part of shaft of humerus

### Contents of axilla

- Axillary artery and its branches
- Axillary vein and its tributaries
- Part of brachial plexus
- Axillary lymph nodes
- Fat and areolar tissue

## AXILLARY ARTERY

---

**It is the continuation of subclavian artery**

#### Extends

- From **outer border of the first rib** To lower border of **teres major**

**Pectoralis minor muscle cross the artery and divides it into three parts**

- **First part** superior to the muscle
- **Second part** posterior to muscle
- **Third part** inferior to muscle



## RELATION OF AXILLARY ARTERY WITH BRACHIAL PLEXUS

---

### First part

**Anterior**-lateral pectoral nerve and loop of communication between lateral and medial pectoral nerve

**Posterior**- Medial cord with medial pectoral nerve

**Lateral**- lateral and posterior cord

### Second part

- **Posterior**- Posterior cord
- **Lateral**- Lateral cord
- **Medial**- Medial cord

### Third part

**Posterior** – Radial nerve and axillary nerve

**Lateral**- lateral root of **median nerve** and **musculocutaneous nerve**

**Medial**-medial cutaneous nerve of arm and medial cutaneous nerve of fore arm

## ERB'S PALSY

---

**Site of injury**- Erb's point

**6 nerves** meet here it is situated in **upper trunk of the brachial plexus**

**Cause of injury damage at shoulder due to**

- **Birth injury**
- Fall on the shoulder
- Anesthesia

**Nerve root involved** - mainly c5 and partly c6

**Muscle paralysed-**

Mainly

- biceps brachii
- deltoid,
- brachialis,
- brachioradialis

**Partly** - supra spinatus and supinator

### **Deformity-**

- **Arm is adducted and medially rotated**
- **Forearm is extended and pronated**

### **Disability**

- ❖ **Abduction and lateral rotation** of the arm is lost
- ❖ **Flaxion** and **supination** of forearm is lost
- ❖ **Biceps and supinator jerks lost**

## **KLUMPKE'S PARALYSIS-**

---

**Site of injury-** lower trunk of brachial plexus

**Nerve root involved** - mainly T1 and partly C8

### **Muscles paralysed**

- ❖ **Intrinsic muscles of hand**
- ❖ **Ulnar flaxors of wrist and finger**

### **Deformity**

- ❖ **Claw hand**
- ❖ In claw hand there is **hyperextansion** at **metacarpo phalangeal joints** and **flexion at inter phalangeal jonts**

### **Disability**

- **Complete claw hand**
- **Cutenious sensation loss** over ulner border of fore arm and hand
- **Horner's syndrome**
  - Ptosis, miosis, anhydrosis, enophthalmos

### **Vasomotor changes**

- Skin becomes **warm** due to **arterio dilatation**
- Skin becomes **dry** due to **loss of sweating** which occurs **due to loss of sympathetic activity**

## **Trophic changes**

- Long duration paralysis Lead to dry and scaly skin
- Nails crack easily

## **DELTOID MUSCLE**

---

### **Origin**

- **Anterior border** of lateral one third of **clavicle**
- **Lateral border** of **acromian process**
- **Lower lip** of **spine of scapula**

### **Insertion**

- **Deltoid tuberosity of humerus**

### **Nerve supply**

- **Axillary nerve**

### **Action**

- **Multipinnate acromial fibers** are powerful **abductor of the arm at shoulder joint up to ninety degree**
- **Anterior fibers** are **flexor and medial rotator of arm**
- **Posterior fiber** are **extensor and lateral rotators of arm**

### **Structure under cover of deltoid**

- Upper end of humerus
- Coracoids process
- Musculo tendinous cuff
- Origin of biceps coraco brachialis and triceps
- Anterior and posterior circumflex humeral artery

### **Clinical anatomy**

- **Intramuscular injection** often given in deltoid
- **Axillary nerve may get damaged** due to dislocation of shoulder joint or **fracture at surgical neck of humerus** then **deltoid is paralysed and actions of deltoid lost**

## MUSCULO TENDINOUS CUFF(ROTATORY CUFF)

---

It is a fibrous sheath formed by the tendons crossing shoulder joint

This tendons while crossing shoulder joint **flatten and join with each other and also with joint capsule**

Muscles which form rotator cuff are

- **Subscapularis**
- **Supraspinatus**
- **Infraspinatus**
- **Teres minor**

This muscle are **originated from scapula**

**Inserted on humerus**

Cuff gives **strength to the capsule** of the shoulder **all around except inferiorly**

That's why **dislocation** of humerus most commonly **occurs in downward direction**.

## BICEPS BRACHI MUSCLE

---

It is the muscle of anterior compartment of arm

**Origin**

- **Short head** from **coracoid process** along with coraco brachialis
- **Long head** from **supraglenoid tubercle**

**Insertion**

- **Radial tuberosity**-posterior rough part
- And **bicipital aponeurosis** which is extension of tendon extend to ulna and separates **median cubital vein from brachial artery**

**Nerve supply**

- **Musculo cutaneous nerve**

**Action**

- It is **strong supinator of fore arm**
- **Flexion of elbow**

- **Short head-** is a flexor of arm
- **Long head-** prevents upward displacements of humerus

### Applied

In **erb's palsy** damage occurs at **erb's point** and **biceps muscle** is affected  
So **flaxion and supination of fore arm** is affected.

## ANASTOMOSIS AROUND THE ELBOW JOINT

---

Anastomosis around elbow joint links brachial artery with upper end of radial and ulnar artery

**In front of the lateral epicondyle** of the humerus

- **Anterior descending artery** (branch of profunda brachii artery)  
With  
**radial recurrent artery**(branch of radial artery)

**behind lateral epicondyle** of the humerus

- **posterior descending artery** (branch of profunda brachii artery)  
with  
**interosseous recurrent artery** (branch of posterior interosseous artery )

**infront of medial epicondyle** of humerus

- **inferior ulnar collateral** artery (branch of brachial artery)  
with  
**anterior ulnar recurrent** artery (branch of ulnar artery)

**behind medial epicondyle of** humerus

- **superior ulnar collateral artery** (branch of brachial artery)  
with  
**posterior ulnar recurrent artery** (branch of ulnar artery)

## CUBITAL FOSSA

---

it is triangular fossa situated on the front of elbow

**boundaries**

- **laterally-** brachioradialis
- **medially-** **pronator teres**
- **base-** by an imaginary line joining epicondyles of humerus
- **apex-** formed by meeting point of lateral and medial boundaries.
- **Roof-** skin, superficial fascia, deep fascia and bicipital aponeurosis
- **Floor** by brachialis and supinator

**Contents**

**From medial to lateral side**

**MBBS**

- **Median nerve**
- **Brachial artery**
- **Biceps brachii tendon**
- **Superficial branch of radial nerve**

**Clinical anatomy**

**Median cubital vein** is used for intravenous injection

**Blood pressure** is recorded by auscultating brachial artery

## BRACHIORADIALIS MUSCLE

---

**It is the muscle of forearm**

**Origin-**

- from lateral supracondylar ridge of humerus

**Insertion-**

- **styloid process of radius**

**Nerve supply**

- Radial nerve

**Action**

- **Flexion of forearm at elbow joint**
- **Rotate forearm to midprone position from supine or prone position**

## CARPAL TUNNEL SYNDROME

---

It is caused by compression of median nerve in the carpal tunnel

In this syndrome

**Motor, sensory, vasomotor and trophic changes occur**

### Motor changes

- Wasting of thenar eminence
- **Ape like thumb deformity**
- **Loss of opposition of thumb**
- **Partial clawing** due to paralysis of **1st and 2nd lumbricals**

### Sensory changes

- Loss of sensations from lateral 3 and half digits

### Vasomotor changes

- Skin becomes **warm** due to **arteriodilatation**
- Skin becomes **dry** due to **loss of sweating** which occurs **due to loss of sympathetic activity**

### Trophic changes

- Long duration paralysis lead to dry and scaly skin
- Nails crack easily

**It occurs both in males and females between age of 25 and 70**

- Main complaint is **pain**
- It occurs **intermittently** over the **distribution of median nerve**
- Frequently **occurs at night**
- It is **more common** due to **excessive working on computer**

## ULNAR NERVE IN HAND

---

### Ulnar Nerve is the Main Nerve In the hand

#### Course

- It passes from superficial to the flexor retinaculum
- It **ends** by dividing into superficial and deep branch

#### Relations

**At wrist-** superficial to flexor retinaculum

It is in relation to ulnar vessels

Here it divides into two branches

#### Branches and supply

Superficial branch Supply

- **Muscle-** Palmaris brevis
- **Cutaneous supply** to medial one and half fingers

Deep branch supply

#### Muscles

- **Hypothenar** muscles
  - Flexor digiti minimi
  - Abductor digiti minimi
  - Opponens digiti minimi
- **4 Palmer** interossei
- **4 dorsal** interossei
- **3 and 4<sup>th</sup>** lumbricals
- **Adductor pollicis**

#### Applied anatomy

Ulnar nerve lesion at the wrist joint

- It produces **ulnar nerve claw hand**
- Hyperextension at the metacarpophalangeal joints and flexion at interphalangeal joint
- **Involving little and ring finger**



- Intermetacarpal space increased due to wasting of interossei muscles

**At wrist joint injury profundus muscle is not paralyzed so flexion at terminal phalanges occur more**

### Sensory changes

- Sensory loss of medial one third of Palm
- medial one and half finger
- Medial half of dorsum of hand

### Vasomotor changes

- Skin becomes **warm** due to **arteriodilatation**
- Skin becomes **dry** due to **loss of sweating** which occurs **due to loss of sympathetic activity**

### Trophic changes

- Long duration paralysis Lead to dry and scaly skin
- Nails crack easily

### Disability

- Person is **unable to spread out fingers** due to paralysis of dorsal interossei
- **Adduction of thumb is lost**
- **Movement of ring and little fingers affected**

## FIRST CARPO METACARPAL JOINT

---

It is the carpometacarpal joint having separate joint cavity

### Type

- Its saddle variety of synovial joint

### Articular surface

- The distal surface of **trapezium**
- Proximal surface of the **first metacarpal bone**

### Ligaments

**Capsular ligament** – It surrounds the joint

**Lateral ligament** - strengthens the capsule from lateral side

**Anterior ligament**

**Posterior ligament**

### Relations

**Anteriorly** - muscles of **thenar eminence**

**Posteriorly** – **extensors** of thumb

**Medially** – first **dorsal interosseus** muscle

**Laterally**- tendon of **abductor pollicis longus**

### **Blood supply**

- Radial vessels

### **Nerve supply**

- Median nerve supplies the capsule of the joint

## Movements

**Flexion**- flexor pollicis bravis

Opponens pollicis

**Extension** – Extensor pollicis brevis

Extensor pollicis longus

**Opposition** – Opponens pollicis

Flexor pollicis bravis

**Abduction** – Abductor pollicis brevis

Abductor pollicis longus

**Adduction** – Adductor pollicis

### Applied

First carpo metacarpal joint can undergo **degenerative changes** with age

- It produces **pain at the base of the thumb**

## **SUPINATION AND PRONATION**

---

Supination and pronation are rotators movements of the forearm/hand

- ❖ In semiflexed elbow, the palm is turned upwards is supination

And downwards is pronation

- ✓ In anatomical position palm is facing forward is **supination** and facing **backward** is pronation

**Joints involved in this movement is**

- Superior and inferior radio-ulnar joint

### Supination

- It is **more powerful** than pronation because it is **antigravity movement**
- It is responsible for **screwing movement of hand**
- It is done by **supinator muscle** and **biceps brachi muscle**
- During supination radius and ulna are parallel to each other

### Pronation

- In semiflexed elbow **palm facing downwards is pronation.**
- **It is towards gravity**
- It is mainly done by **pronator quadratus**
- Also by **pronator teres**
- **During pronation radius cross over the ulna**

### Clinical anatomy

#### **Synostosis**

- When upper end of radius and ulna fused known as **synostosis**
- In this condition **pronation is not possible**

## **SUPERFICIAL PALMER ARCH**

---

**Superficial and deep Palmer arch represents the anastomosis between the ulnar and radial artery**

#### Formation

- **Superficial Palmer arch is formed** as the direct continuation of the ulnar artery
- The arch is **completed by superficial Palmer branch of radial artery**

### Relations

- It lies **deep** to **palmaris Bravis** and **Palmer aponeurosis**
- It lies **superficial** to **flexor tendons of the fingers and lumbricals**

### Branches

- Three common digital and one proper digital branch **Supplying medial 3 and half fingers**
  - Digital arteries are joined with deep Palmer arch by **Palmer metacarpal arteries**

## DEEP PALMER ARCH

---

It is connecting the radial artery and ulnar artery

### Formation

- It is formed by the **terminal part of radial artery**
- And **completed medially** by **deep branch of ulnar artery**

### Relations

- It lies **deep** to **flexor tendons of fingers and lumbricals**.
- It **lies on the metacarpals and interossei**.

### Branches

- **Three Palmer metacarpal arteries** which join with common digital branches of superficial Palmer arch
- **Three perforating digital** arteries
- **Recurrent branches** for supplying carpal bones and joints

## FLEXOR RETINACULUM

---

It is the strong fibrous bend which is present at flexor aspect of wrist and carpal bones

- It converts **anterior concavity of carpal bones into a tunnel**

### Attachments

**Medially** - Pisiform bone **and** Hook of hamate

**Laterally-** Scaphoid **and** Trapezium

**Retinaculum having slip**

**Lateral deep slip** - Form a tunnel from which **tendon of flexor Carpi radialis** pass

**Medial superficial slip** - **Ulnar vessels and nerve** pass deep to the slip

**Relations**

**Structure passing superficial to flexor retinaculum**

- Palmaris longus tendon
- Palmer cutaneous branch of the median nerve
- Palmer cutaneous branch of ulnar nerve
- Ulnar vessels and nerve

**Structure passing deep to the flexor retinaculum**

- **Median nerve**
- **Four tendons of flexor digitorum superficialis**
- **Four tendons of flexor digitorum profundus**
- Tendon of flexor pollicis longus
- Ulnar bursa
- Radial bursa
- Tendon of flexor Carpi radialis

## EXTENSOR RETINACULUM

---

**Deep fascia on the back of wrist is thickened to form Extensor retinaculum**

- It is **oblique band**. It is directed **downwards and medially**

**Attachments**

**Laterally** - lower part of radius

**Medially-** styloid process of ulna, Triquetral and pisiform bone

The retinaculum sends septa which are attached on the posterior surface of radius

**So six compartments are formed**

**Content**

<b>1st</b>	<b>Abductor pollicis longus</b> <b>Extensor pollicis brevis</b>
<b>2nd</b>	<b>Extensor Carpi radialis longus</b> <b>Extensor Carpi radialis brevis</b>
<b>3<sup>rd</sup></b>	<b>Extensor pollicis longus</b>
<b>4th</b>	<b>Extensor digitorum</b> <b>Extensor indicis</b> <b>Posterior interosseous nerve</b> <b>Anterior interosseous artery</b>
<b>5th</b>	<b>Extensor digiti minimi</b>
<b>6th</b>	<b>Extensor Carpi ulnaris</b>

# Thorax

## THE INFERIOR APERTURE/OUTLET OF THE THORAX/ DIAPHRAM

---

It separate thorax from abdominal cavity. That is diaphragm.

### Boundaries

**Anteriorly:**      Infrasternal angle

**Posteriorly:**    Twelfth thoracic vertebra.

**On each side:**   Seventh to twelfth ribs.

### ***Structures passing through the diaphragm***

There are **three large**, and several small, openings part of the diaphragm.

### **Large opening in the diaphragm.**

- **T8 level** Vena caval opening
  - **Inferior vena cava**
  - Branch of right phrenic Nerve
  
- **T10 level** Oesophageal opening
  - **Oesophagous**
  - **Vagus nerve**
  - Oesophageal branch of left gastric artery with some oesophageal veins
  
- **T12 level** Aortic opening
  - **Aorta**
  - **Thorasic duct**
  - **Azygous vein**

### **Small Openings in the Diaphragm**

---

#### **medial lumbocostal arch.**

- **The sympathetic chain** passes from the thorax to the abdomen behind the medial arcuate ligament also called the **medial lumbocostal arch**.

#### **lateral lumbocostal arch**

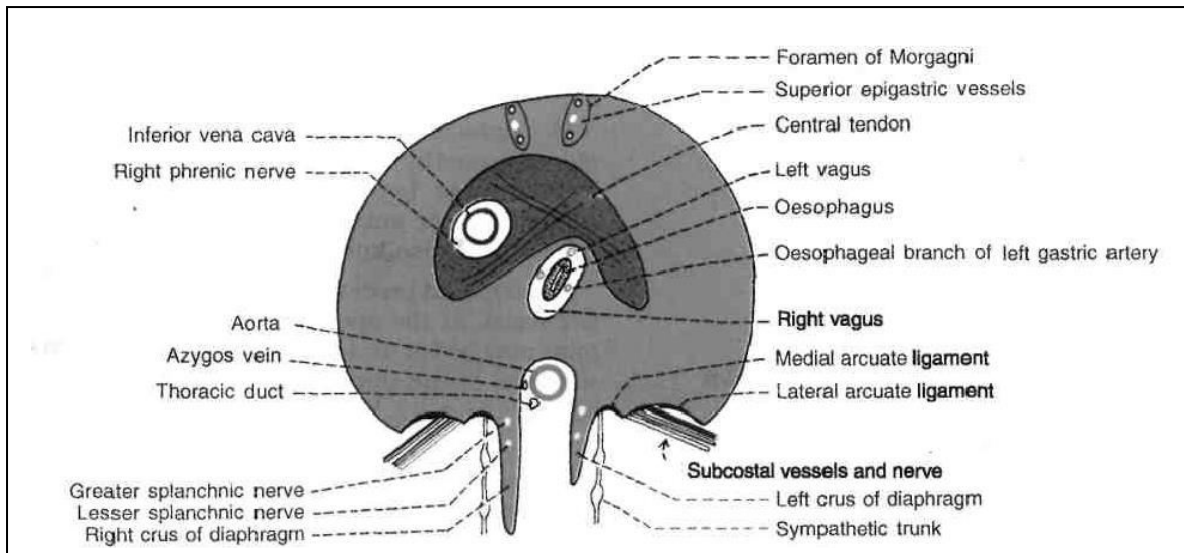
- **The subcostal nerve and vessels** pass behind the lateral arcuate ligament or lateral lumbocostal arch.



### foramen of Morgagni

- The gap between the xiphoid, 7th costal cartilage and origins of the diaphragm is foramen of Morgagni.

**The superior epigastric vessels and lymphatics pass through it.**



## RESPIRATORY MOVEMENTS

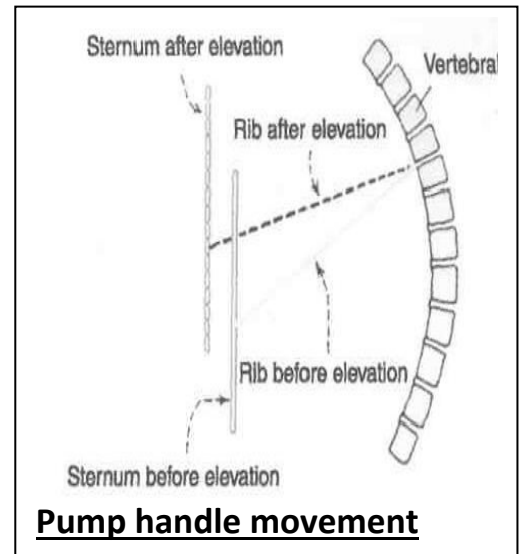
The lungs expand passively during inspiration and retract during expiration.

### Principles of Movements

#### pump-handle movements.

- The anterior end of the rib is **lower** than the posterior end.
- Therefore, **during elevation of the rib**, the anterior end also moves **forwards**.
- In this way, the **anteroposterior diameter of the thorax is increased**.
- Along with the up and down movements of the ribs, the **body of the sternum** also moves up and down called **pump-handle movement**.
- It is brought about by **elevation of the second to sixth ribs**.

**Partly by elevation of the seventh to tenth ribs**



#### 'bucket-handle' movements

- **The middle of the shaft** of the rib lies at a **lower level** than the **plane** passing through the **anterior and posterior end** of the ribs.
- **Therefore, during elevation of the rib**, the **shaft** moves **outwards**.
- This causes **increase in the transverse diameter of the thorax** called **'bucket-handle' movements**.
- **Mainly by the seventh to tenth ribs** **Partly by elevation of the second to sixth**

#### The vertical diameter is increased

It is done by **downward movement of the diaphragm**.

## Clinical Anatomy

**Dyspnoea** means **Difficulty in breathing**

- the patients are **most comfortable** on sitting position.

**The diaphragm is lowest while sitting.**

The patient is quite comfortable as the effort required for inspiration is the least

## INTER COSTAL SPACE

The gap between the ribs is called intercostals space.

- They are filled by the **intercostal muscles** and **contain the intercostal nerves, vessels and lymphatics.**

### Intercostal Muscles-

- External intercostal muscle,
- Internal intercostal muscle, and
- Transversus thoracis muscle
  - Transversus thoracis is divisible into three parts
    - Subcostalis
    - Intercostalis intimi
    - Sternocostalis.

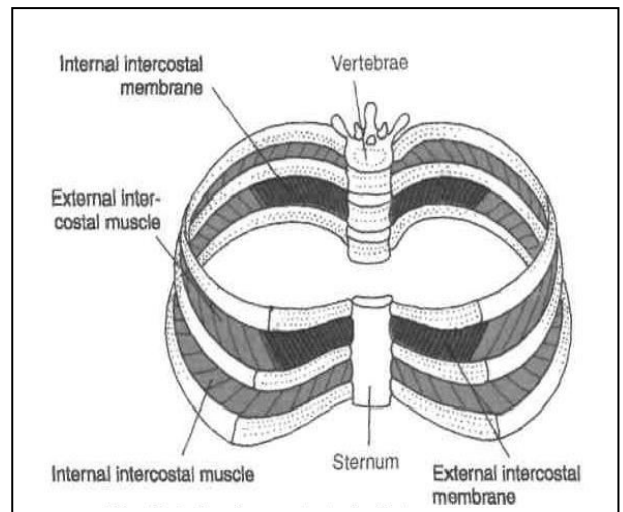
### Direction of Fibres

#### IN THE ANTERIOR PART OF THE INTERCOSTAL SPACE:

1.The fibres of the **external intercostal muscle** Run downwards, forwards and medially

2.The fibres of the **internal intercostal** run downwards, backwards and laterally, **at right angle to the external intercostal.**

3.The fibres of the **transversus thoracis** run in **same direction** as those of the **internal intercostal**



### Nerve Supply

intercostal muscles are supplied by **the intercostals nerves** of the spaces in which they lie.

### Actions of the Intercostal Muscles

- The **main action** of the intercostal muscles is to **prevent retraction or bulging** of the **intercostal spaces**

## Intercostal Nerves

- The **intercostal nerves** are the **anterior primary rami** of thoracic 1 to 11 spinal nerves.
- The anterior primary ramus of the **12th thoracic nerve** forms the **subcostal nerve**.

The relationship of structures in the **costal groove** from **above downwards** is **vein-artery-nerve (VAN)**

## Intrercostal Arteries

- Each intercostal space contains **one** posterior inter-costal artery with its collateral branch and **two anterior intercostals arteries**.
- Greater part of the space is supplied by **posterior intercostal artery**.
- They are 11 **posterior intercostal artery** in number on each side.  
One in each space.

## Intercostal Veins

- There are **two anterior intercostal veins** in each of the **upper nine** spaces.
- There is **one posterior intercostal vein** and **one collateral vein** in each intercostal space.

Each vein accompanies the corresponding artery and lies superior to the artery.

## Lymphatics of an Intercostal Space

- Lymphatics from the anterior part of the spaces pass to the anterior intercostal or **internal mammary lodes**.
- Lymphatics from the posterior part of the space pass to the **posterior intercostal nodes**.

## THE AZYGOS VEIN

---

It forms an important channel connecting the superior and inferior venae cavae.  
The term 'azygos' means unpaired.

### Formation

The azygos vein is **formed by union of**

**The lumbar azygos, Right subcostal and Right ascending lumbar veins.**

- Occasionally the lumbar azygos vein is absent.

### Course

---

*The azygos vein enters the thorax by passing through the aortic opening of the diaphragm.*

*The azygos vein then ascends up to fourth thoracic Vertebra*

*It arches forwards over the root of the right lung.*

*It ends by joining the posterior aspect of the superior vena cava.*

---

### Relations.

**Posteriorly:** Lower **eight thoracic vertebrae**

**To the right:** Right lung and pleura

**To the left:**

- Thoracic duct and aorta in lower part.
- Oesophagus and trachea in the upper part.

### Tributaries

- **Right superior intercostal vein**
- Fifth to eleventh right posterior intercostal veins
- Hemiazygos vein
- Accessory hemiazygos vein

### CLINICAL ANATOMY

- In superior vena caval obstruction, azygos vein is main channel which transmits the blood from the upper half of the body to **to the inferior vena cava.**

## PLEURA AND ITS APPLIED

---

Pleura is a **serous membrane**.

It has **two layers**.

- Outer layer is the ***parietal pleura***.
- Inner layer is ***visceral pleura***

The two layers are **continuous with each other** around the **hilum of the lung**.

There is a **potential space** between **two layers** known as **the pleural cavity**

### visceral pleura

- ***visceral pleura*** covers the surface of the lung, except at the hilum.
- Along the **attachment of the pulmonary ligament** where it is continuous with the parietal pleura.
- **It is firmly adherent to the lung and cannot be separated from it.**

### The Parietal Pleura

The parietal pleura is **thicker** than the ***visceral pleura***,

It is subdivided into **four parts**:

- costal,
- diaphragmatic,
- mediastinal, and
- cervical

**The costal pleura** lines the thoracic wall related to ribs and intercostal spaces.

**The mediastinal pleura** lines the mediastinal surface of lung

- It is reflected over the Hilum and becomes continuous with the ***visceral pleura*** around the hilum.

**The cervical pleura** extends into the neck, above the first costal cartilage and clavicle.

- It covers the apex of the lung.

**Diaphragmatic pleura** lines the superior aspect of diaphragm.

- **It covers the base of the lung.** It is continuous with mediastinal pleura medially and costal pleura laterally.

### The Pulmonary Ligament

The parietal pleura surrounding the root of the **lung extends downwards** beyond the **root as a fold** called the **pulmonary ligament**.

It provides a dead space into which the pulmonary veins can expand during increased venous return as in exercise.

### RECESSES OF PLEURA

---

There are **two folds of recesses** of parietal plura.

#### Costomediastinal recess-

- It is between the **costal and mediastinal plura**.
- It lies behind the sternum and costal cartilages.

This recess is filled up by the anterior margin of lungs.

It is filled up during quite breathing also.

#### Costodiaphragmatic recess-

- It lies between the costal and diaphragmatic Plura.

Vertically it measures about 5 cm.

- It extends from **eighth to tenth ribs along mid axillary line.**

- These recesses act as a **reserve spaces for the lung** to Expand during deep inspiration.

So they are **well defined in expiration** and not in deep inspiration.

### Nerve Supply of the Pleura

---

#### Parital plura.

- Intercostal and phrenic nerves supply parital plura.
- The parietal pleura is pain sensitive.

#### Visceral Pleura

- It is supplied by **autonomic nerves**.
- **The sympathetic nerves** from **2<sup>nd</sup> to 5<sup>th</sup> spinal Segments**.
- **Parasympathetic nerves** from the **vagus nerve**.
- This part of the pleura is not sensitive to pain.

### Blood Supply and Lymphatic Drainage of the Pleura

---

The **parietal pleura** supplied by intercostal arteries.

The **veins** drain mostly into the azygos and internal thoracic veins.

The **lymphatics** drain into the intercostals nodes.

The **Visceral Pleura** is supplied by the **bronchial arteries**  
the **veins** drain into **bronchial veins**.

The **lymphatics** drain into **bronchopulmonary lymphnodes**.

## CLINICAL ANATOMY OF PLEURA

---

### **Pleurisy-**

This is inflammation of the pleura.

**Pleurisy accompaneid by collection of fluid in the pleural cavity.**

The condition is called the **pleural effusion**.

- It cause obliteration of costodiaphragmatic recess.

**Pneumothorax**. Presence of **air in the pleural cavity**.

**Haemothorax**. Presence of **blood in the pleural cavity**.

**Hydropneumothorax** Presence of both fluid and air in the pleural cavity.

**Empyema** Presence of pus in the pleural cavity.

### **Paracentesis thoracis.**

- Aspiration of fluid from the pleural cavity is called **paracentesis thoracis**.
- It is usually done in the **eighth intercostal space in the midaxillary line**.
- The needle is **passed through the lower part of the space** to avoid injury to **neurovascular bundle**.

### **Reffered pain**

**Costal plurae Irritation** cause reffered pain along thorax and Abdominal wall.

**Mediastinal and diaphragmatic plura** Irritation cause referred pain on the tip of Shoulders.



## ROOT OF THE LUNG

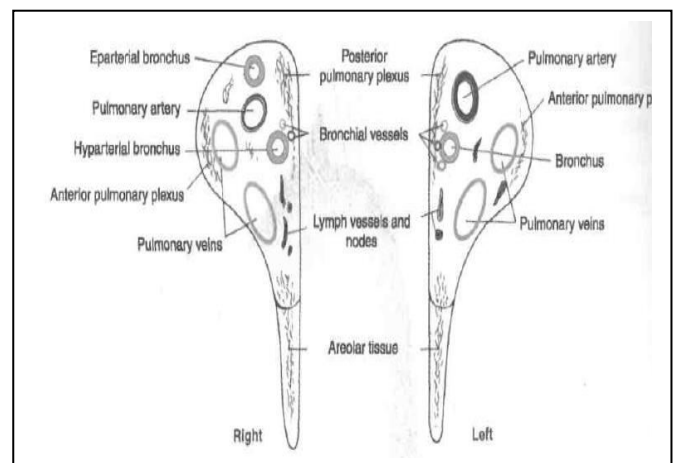
Root of the lung is a **short, broad pedicle** which **connects** the medial surface of the lung to the mediastinum.

- It is formed by structures which either enter or come out of the lung.

### Contents

The root is made up of the following structures:

- Principal bronchus on the left side, and eparterial and hyparterial bronchi on right side.
- One pulmonary artery.
  - Two pulmonary veins, superior and inferior.
  - Bronchial arteries, one on the right side and two on the left side.
  - Bronchial veins.
  - Anterior and posterior pulmonary plexuses of nerves.
  - Lymphatics of the lung.
  - Bronchopulmonary lymph nodes.
  - Areolar tissue.



### Arrangement of Structures in the Root

From before backwards. It is similar on the two sides

[ VAB ]

- Superior pulmonary vein
- Pulmonary artery
- Bronchus

From above downwards. It is different on the two sides.

#### **Right side**

- Eparterial bronchus
- Pulmonary artery
- Hyparterial bronchus
- Inferior pulmonary vein

#### **Left side**

- Pulmonary artery
- Bronchus
- Inferior pulmonary vein

### Relations of the Root

---

Common on the two sides

#### Anterior

- Phrenic nerves

#### Posterior

- Vagus nerve

#### Inferior

- Pulmonary ligament

#### Superior Relation

**On Right side** – Terminal part of azygous vein

**On Left side** – Arch of Aorta

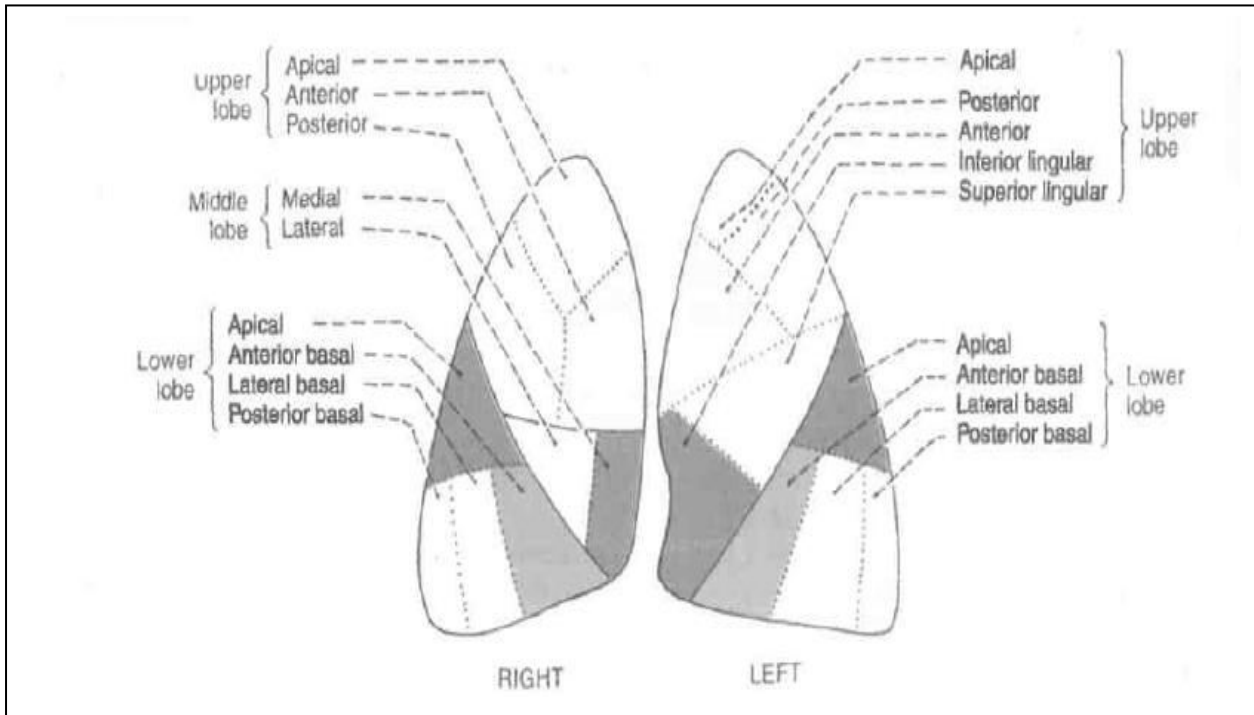
## BRONCHOPULMONARY SEGMENTS

---

**These are well defined anatomic, functional and surgical Sectors of the lung.**

- Each one of which is provided by a tertiary bronchus.

- Each segment is pyramidal in shape with its apex directed towards the root of the lung.
- Each segment has a tertiary bronchus, Segmental artery, autonomic nerves and lymphvessels.
- There are 10 segments on the right side and 10 on the left side.
- Bronchopulmonary segments are independent respiratory units.



### Clinical anatomy

1. Usually the **infection of a segment remains restricted to bronchopulmonary segment**

But infections like tuberculosis may spread from one segment to another.

**Knowledge of the bronchopulmonary segment helps in:**

- **Surgical removal of a segment**
- **postural drainage.**
- **Bronchoscopy**

## SINUSES OF PERICARDIUM

### Transverse sinus of pericardium

The **epicardium** at the roots of the great vessels is arranged in form of two tubes.

- **The arterial tube** encloses the ascending aorta and the pulmonary trunk at the arterial end of the heart tube
- **venous tube** encloses the venae cavae and pulmonary veins at the venous end of the heart tube.

**The passage between the two tubes is known as the *transverse sinus*.**

The *transverse sinus* is a horizontal gap between arterial and venous ends of the heart tube.

**It is bounded**

Anteriorly- ascending aorta and pulmonary trunk

Posteriorly- superior vena cava

Each side - it opens into pericardial cavity

### **oblique pericardial sinus**

- During development As the heart increases in size and these veins separate out
- **Pericardial reflection surrounds all of them and forms the oblique pericardial sinus.**

**This is situated posterior to the left atrium.**

The ***oblique sinus*** is a narrow gap **behind the heart. It is bounded**

**Anteriorly** - Left atrium

**Posteriorly** - Parietal pericardium.

**On the right and left sides** it is bounded by **reflections of pericardium**

it opens into pericardial cavity.

---

## THE RIGHT ATRIUM

- The right atrium is the right upper chamber of the heart.

- It receives venous blood from the whole body, pumps it to the right ventricle

### **External Features**

- The chamber receiving the superior vena cava at the upper end and the inferior vena cava at the lower end.
- **right auricle.**
  - The upper end is prolonged to the left to form the right *auricle*.

### **sulcus terminalis**

- Along the right border of the atrium there is a shallow vertical groove which passes from the superior vena cava to the inferior vena cava.
- This groove is called the *sulcus terminalis*.
- It is produced by an internal muscular ridge called the ***crista terminalis***

**The upper part of the sulcus contains the *sinuatrial or SA node* which acts as the pacemaker of the heart.**

### **The right atrioventricular groove**

- The right atrioventricular groove separates the right atrium from the right ventricle

### **Tributaries or Inlets of the Right Atrium**

---

- Superior vena cava,
- inferior vena cava,
- coronary sinus,
- anterior cardiac veins,
- venae cordis minimi (Thebesian veins),
- sometimes the right marginal vein.

### **Right Atrioventricular Orifice**

- Blood passes out of the right atrium through the right **atrioventricular or tricuspid** orifice and goes to the right ventricle.
- The tricuspid orifice is guarded by the **tricuspid valve** which maintains unidirectional flow of blood

### **Internal Features**

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- The interior of the right atrium can be broadly divided into the following three parts.

### **The Smooth Posterior Part**

- Most of tributaries opens into it
- Superior vena cava, inferior venacava, coronary sinus open into it
- Intervinous tubercle of lower is small projection. During embryonic life it directs blood from superior venacava to right ventricle.

### **Rough anterior part**

- It is rough due to transverse muscular ridges called muscoli pectinati

### **Interatrial Septum**

- Developmentally it is derived from the septum primum and septum secundum.
- It presents the **fossa ovalis** and *limbus fossa ovalis*.

### **Clinical anatomy**

---

**Foramen ovale may remain open** after birth leads to mixing of blood of right atrium and left atrium.

## BLOOD SUPPLY OF HEART

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- Heart is supplied by two coronary arteries
- They origin from aorta.

### Right coronary artery

---

**Origin-** anterior aortic sulcus

**Course-**

- it runs forward
- Then downwards in the right coronary sulcus
- It wind rounds inferior border and reach diaphragmatic surface
- Reach up to posterior inter ventricular groove

**Termination -**

By anastomosing with circumflex branch of left coronary artery

**Branches -**

- Marginal
- Posterior interventricular branch
- nodal branch

**Area of distribution**

- Right atrium
- Ventricles - right ventricle except anterior inter ventricular groove  
Small part of left ventricle at posterior interventricular groove
- Conducting system of heart

### Left coronary artery

---

**Origin -** left posterior aortic sinus

**Course -**

- Runs forward
- Gives anterior interventricular branch
- Then runs into left anterior coronary sulcus
- Winds round left border of the heart And now known As circumflex artery
- Reach posterior inter ventricular groove.

**Termination** - Anastomose with right coronary artery

### **Branches-**

- anterior interventricular branch
- Diagonal branch
- Left atrial branch

### **Area of distribution**

- Left atrium
- Ventricles-
- Great part of left ventricle except posterior interventricular groove
- Small part of right ventricle at anterior interventricular groove
- Anterior part of interventricular septum

## **Clinical anatomy**

---

### **Thrombosis of coronary artery**

- Formation of thrombus in coronary artery leads to shortening of lumen of artery
- And blood supply to heart is decreased and results in myocardial infarction
- Severe pain over chest occurs

### **Incomplete obstruction leads to spasm of artery**

- And results in angina pectoris
- That pain radiates towards medial side of the left arm forearm.

### **Coronary angiography**

- Is done to diagnose occlusion of coronary arteries

### **Angioplasty**

- Is done to remove small obstruction in coronary arteries
- In this procedure small stent is used
- Or balloon is inflated at obstructed site

### **Bypass surgery**

- Is done if blockage is at multiple sites
- In this procedure great saphenous vein or internal thoracic artery is used as graft



## ARCH OF AORTA

Aorta is the **great arterial trunk** receives **oxygenated blood from the left ventricle** and **distributes it to all parts of the body**

**It is studied in the following three parts**

- Ascending aorta
- Arch of aorta
- Descending aorta

**Arch of aorta**

- Arch of aorta is the **continuation of the ascending aorta**
- It is situated in the **superior mediastinum**

**Course**

- **It begins at the level of sternal angle** behind second right sternochondral joint
- **It runs upward, backward and to the left side**
- It arches over the left root of lung
- **It ends at the lower border of the fourth thoracic vertebrae** by becoming continuous as the descending aorta
- **Thus it starts anteriorly and ends posteriorly at same level.**

**Relations**

**Superiority**

Three branches of the aorta

- Brachiocephalic artery
- Left common carotid artery
- Left subclavian artery

**Inferiority**

- Bifurcation of pulmonary trunk
- Left Recurrent Laryngeal Nerve

**Posteriorly**

- Trachea
- Oesophagus
- Vertebral column

**Anteriorly**

- Left phrenic and left Vagus nerve
- Left pleura and left lung

**Branches**

1. **Brachiocephalic artery** which divides into the right common carotid artery and right subclavian artery
2. **Left common carotid artery**

### 3. left subclavian artery

## Clinical anatomy

---

**Aortic knuckle** - it is the **shadow of aorta** in the **PA view of x-Ray of chest**.

**Coarctation of aorta** - **Narrowing of aorta**

- It occurs mainly just beyond the attachment of ductus arteriosus.

**Aortic aneurism-** **It is the abnormal dilatation of aorta**

- It compress surrounding structures

## THORACIC DUCT

---

**It is the largest lymphatic of the body**

It is about 45 cm long. It had beaded appearance

### Course

- It is a **continuation** of the **cisterns Chyli**
- It **starts at the level of twelfth thoracic vertebra** and enters the thorax from aortic opening of the diaphragm
- **Ascends** from **posterior mediastinum**
- **Crossing** from **right to left side** at the level of **fifth thoracic vertebrae**
- Further ascends
- **Reaches neck up** to level of **7 th cervical vertebrae**
- Descends and finally
- **Ends by opening into the angle between the left subclavian and left internal jugular veins**

### Relations

---

**At the aortic opening of the diaphragm**

**Anteriorly** - diaphragm

**Posteriorly**- vertebral column

**To the right**- azygous vein

**To the left**- aorta

### Tributaries

---

- **It receives the lymph from Both the half of body below diaphragm and left half above the diaphragm**

**At the ending part it receives lymph from**

- Left jugular lymph trunk
- Left subclavian lymph trunk
- Left bronchi mediastinal lymph trunk

Abdomen

And

Pelvis

## Abdomen

---

### What is abdomen?

It is **the lower part of trunk** and lies below the diaphragm

It is divided by a **plane of the pelvic inlet**

- larger upper part abdomen proper
- smaller lower part true or lesser pelvis

Abdomen and pelvis form the biggest cavity in the body

### Boundaries of abdomen

---

#### Roof-

- Undersurface of diaphragm

#### Floor-

- Pelvic diaphragm mainly

#### Anterior wall-

- It is musculo-fibrous and formed by muscles and their apponeurosis

#### Posterior wall-

- Osseo-musculofascial and rigid

## ANTERIOR ABDOMINAL WALL

---

**it is covering the abdominal cavity anteriorly**

it is made up of **six** layers

1. skin
2. superficial fascia
3. muscles
4. continuous layer of fascia
5. extraperitoneal connective tissue
6. the peritoneum

it includes both the front as well as side walls of the abdomen so called **antero-lateral abdominal wall**

## Abdominal Skin

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**skin the outermost layer**

- it is capable of undergoing enormous stretching

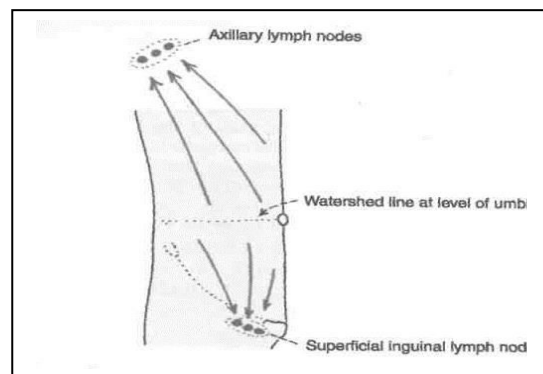
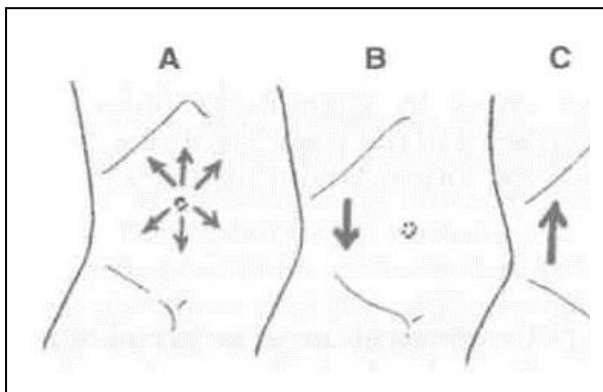
## UMBILICUS

**Normal scar** formed by remanants of the root of the umbilical cord

- **position**- variable
- in healthy adult it lies in the antriormedin plane at the level b/w 3 & 4 th lumbar vertebrae

### Water Shed Line

- venous blood and lymph which are above the plane goes upwards  
down the plane go downwards  
they do not cross normally. **That line passing from umbilicus is water shed line**
- But in some abnormalities its open up and **dilated veins** seen radiating from the umbilicus known as **caput medusae**
- Dilated veins normally do not break water shed line
- **Embryological importance of umbilicus**-  
Meeting point of three system digestive, excretory and vascular system



## LINEA ALBA

- It is a **Tendinous Raphe**
- **Extending** from xiphoid process to the pubic symphysis
- Formed by **crossing** the apponeurosis of two sides muscle
- Apponeurosis of each muscle made up of two laminae
- **Superficial and deep laminae**- this lamina interdigitate in a manner that superficial lamina of one side continuouse with deep lamina of other side.

## RECTUS ABDOMINIS MUSCLE

**Origin-** Two tendinous head

- **Lateral head** from the pubic crest lateral part
- **Medial head** from anterior pubic ligament

**Direction-** fibres run vertically upwards

**Insertion-**

- Lateral to xiphoid process on 7,6 and 5 th costal cartilage

**Nerve supply –**

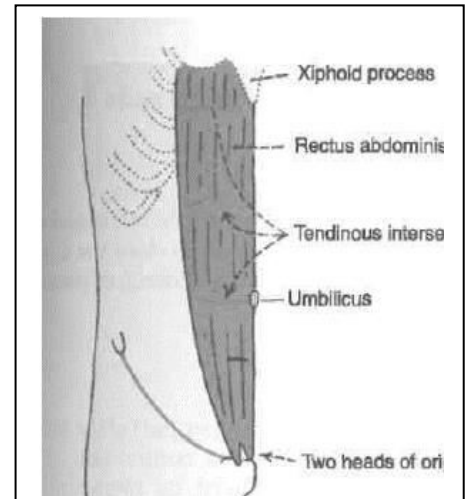
- Lower six or seven thoracic nerves

### Points to remember about RAM

- Muscle is enclosed in a sheath which is known as **rectus sheath**

**Tendinous insertion-**

- There are three transeverse bands
- 1<sup>st</sup> opposite to umbilicus
- 2<sup>nd</sup> free end of xiphoid process
- 3<sup>rd</sup> between 1<sup>st</sup> and 2<sup>nd</sup>



### **Action of muscle of anterior abdominal wall**

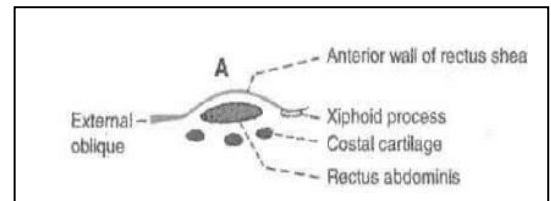
- **Support of abdominal viscera-**
- **Expulsive act-**
  - like micturation, defecation parturation, vomiting
- **Forcefull expiratory act-**
  - mainly external oblique which is useful for coughing, sneezing, shouting.
- **Movement of the trunk-**
  - Flexion of the trunk- **mainly by RA**
  - Lateral flexion- **same side of IO and EO**
  - Rotation of the trunk **same side EO and opp IO**

## RECTUS SHEATH

- This the **aponeurotic sheath** covering the rectus abdominis
- **Having two walls-**
  - **Anterior**
    - It's a complete covering muscle from end to end
  - **Posterior**
    - Its incomplete. Deficient above the costal margin and below the arcuate line

### Above the costal margin

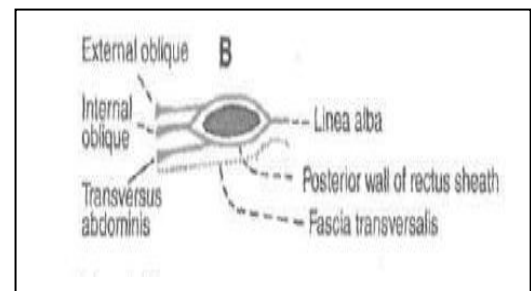
- **Anterior** – external oblique aponeurosis
- **Posterior**- deficient
  - It directly rest on 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> costal cartilage



### Between costal margin and arcuate line

#### Anteriorly-

- External oblique aponeurosis
- Anterior lamina of the aponeurosis of the internal oblique

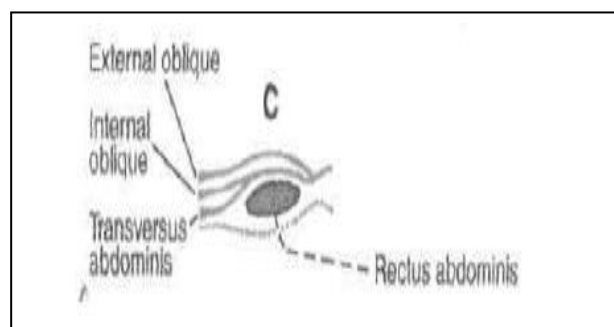


#### Posterior wall

- Posterior lamina of the aponeurosis of the internal oblique
- Aponeurosis of the transverse muscle

### Below the arcuate line

- **Anterior wall**
  - Aponeurosis of all the three muscles of abdomen
- **Posterior wall**
  - Deficient
  - **Directly rest on fascia transversalis**





## **Content of rectus sheath**

---

**Muscle-** rectus abdominis main

- Pyramidalis lies in front of lower part of rectus abdominis

**Arteries**

- Superior epigastric artery
- Inferior epigastric artery

**Veins**

- Superior epigastric vena comitantes
- Inferior epigastric vena comitantes

**Nerve**

- Lower six thoracic nerves

## **Function of rectus sheath**

- It **checks the bowing** of the **rectus Abdominis** muscle during contraction
- It maintains the **strength** of anterior abdominal wall

# INGUINAL CANAL

## Definition

- Inguinal canal is an **oblique passage** in the lower part of the anterior abdominal wall. It is situated just above the medial half of the inguinal ligament.

## Length and direction:

- It is about 4 cm (1.5 inches) long.
- It is directed downwards, forwards and medially.

## Extention

- It extends from the **deep inguinal ring** to the **superficial inguinal ring**.

**The deep inguinal ring** is an **oval opening** in the fascia transversalis.

**The superficial inguinal ring** is a **triangular gap** in the external oblique aponeurosis.

## Boundaries

### anterior wall

*In its whole extent:*

- Skin
- superficial fascia
- **external oblique aponeurosis**.

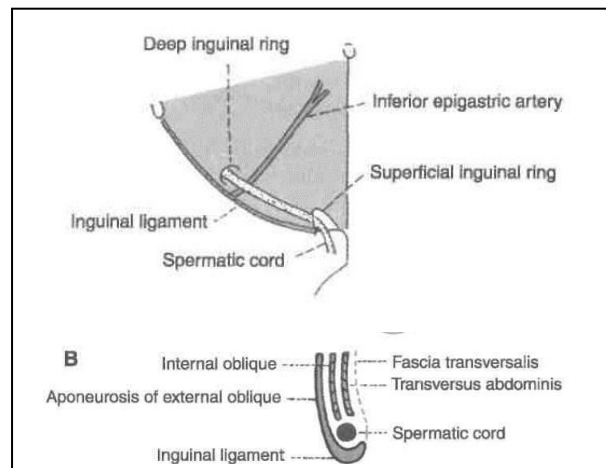
### posterior wall

**In its whole extent:**

- **fascia transversalis**
- extraperitoneal tissue
- parietal peritoneum.

**In its medial two-thirds**

- **conjunct tendon**



**Roof - internal oblique and transversus abdominis muscles**

**Floor - inguinal ligament**

## Sex Difference

- The inguinal canal is **larger in males than in females**.

## STRUCTURES PASSING THROUGH THE INGUINAL CANAL

- **Spermatic cord** *in males*,
- **Round ligament of the uterus** *in females*,

They Enter the inguinal canal through the deep inguinal ring and passes out through the superficial inguinal ring.

- **The ilioinguinal nerve**

### Contents of the Spermatic Cord

These are as follows.

**(1) The ductus deferens**

**(2) Arteries**

- The testicular arteries
- cremasteric arteries
- the artery of the ductus deferens.

**(3) veins.**

- The pampiniform plexus of veins.

**(4) Lymph**

- lymph vessels from the testis.

**(5) Nerve**

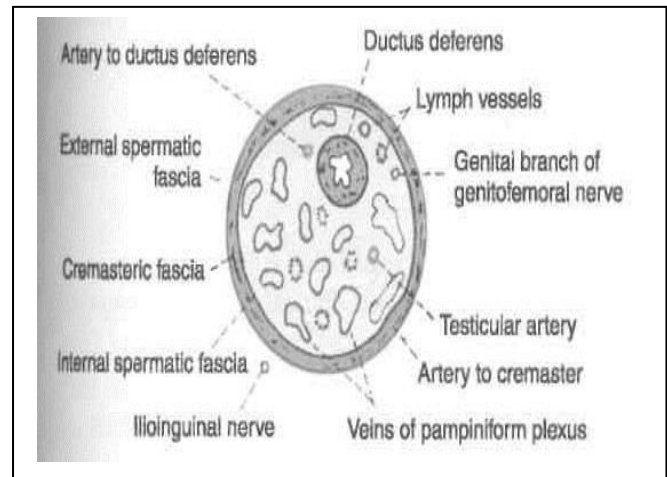
- Genital branch of the genitofemoral nerve
- Plexus of sympathetic nerves around the artery to the ductus deferens.

**(6) Remains of the processus vaginalis.**

### Coverings of Spermatic Cord

From inside to outwards, these are as follows.

1. **Internal spermatic fascia**
2. **Cremasteric fascia**
3. **External spermatic fascia**



## CLINICAL ANATOMY OF INGUINAL CANAL

### Hernia

Hernia is **abnormal protrusion** of any of **body contents** through any of its wall

**Hernia Consists of sac, contents, and coverings**

- **Sac** is the protrusion of the peritoneum. It has **neck** which is narrowed part and **Body** which is bigger part.
- **Contents** are mobile part they can be **intestine** or **omentum** or other viscera
- **Covering** are the layers of abdominal wall covering hernia sac.

### INGUINAL HERNIA

**Abnormal protrusion of abdominal contents** (greater omentum and intestines) **into the inguinal canal** is known as inguinal hernia.

#### Cause

This is more likely to occur in persons in whom intra-abdominal pressure is frequently increased, e.g.

- chronic cough,
- by work involving frequent lifting of heavy weights

### Types of Inguinal Hernia

#### **DIRECT INGUINAL HERNIA**

When the contents of the hernia enter the inguinal canal through the posterior wall the hernia is said to be **direct Inguinal Hernia**

- A direct hernia passes through Hesselbach's triangle

The triangle is **divided into medial and lateral parts by the obliterated umbilical artery**.

- Direct hernia through the medial part known As **direct medial hernia**
- Direct hernia through lateral parts of the Triangle are referred as **direct-lateral hernias**

#### **Hesselbach's triangle**

which is bounded

**medially** by the lateral border of rectus abdominis,

**laterally** by the inferior epigastric artery, and

**below** by the inguinal ligament.

- Direct inguinal hernia occurs in **old age**, when the abdominal muscles become weak.
- It is frequently **bilateral and incomplete**

### INDIRECT INGUINAL HERNIAS

---

When the **contents of the hernia** enter the inguinal canal by passing through the deep inguinal ring the hernia is said to be **indirect inguinal hernia**.

- Indirect inguinal hernias may be congenital.
- It may occur in the young through areas of **congenital weakness produced by descent of the testis**.

#### Processusvaginalis

During the descent of the testis, **a pouch of peritoneum** descends through the inguinal canal into the scrotum is the *processusvaginalis*.

**Abnormal persistence of the processus** is causative factor in the production of **inguinal hernias and hydrocele**.

**Congenital hernia** : The entire processusvaginalis remains patent and the contents of the hernia pass through it into the scrotum.

#### Complications of Hernia

**Irreducibility**- When **Hernia content** do not go back and produce persistent swelling considered as irreducible hernia

**Obstruction**- **Loop Get narrowed** so content of the loop cannot move leading to obstruction. **But blood supply is intact**.

#### **Strangulation**-

When **arterial supply of hernia content** **also gets blocked** the loop get necrosed called as strangulation.

## EPIPLOIC FORAMEN/FORAMEN OF WINSLOW

This is a **vertical slit-like opening** through which the lesser sac communicates with the greater sac.

- The foramen is situated behind the **right free margin of the lesser omentum** at the level of the **12th thoracic vertebra.**

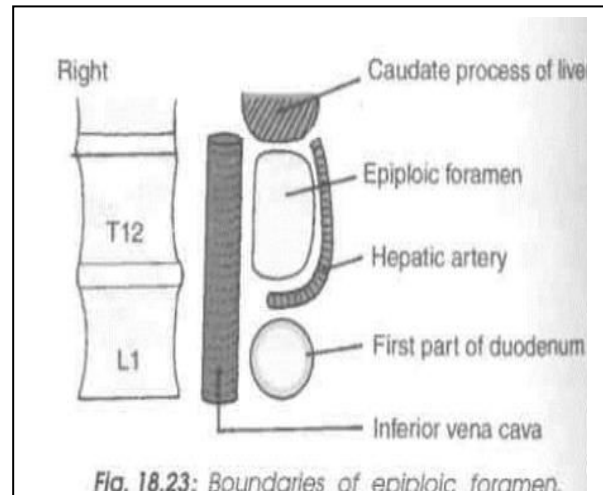
### Boundaries

**Anteriorly:** Right free margin of the lesser Omentum containing the portal vein, the hepatic artery, and the bile duct

**Posteriorly:** The inferior vena cava, the right suprarenal gland and T12 vertebra.

**Superiorly :**Caudate process of the liver.

**Inferiorly :****First part of the duodenum** and the horizontal part of the hepatic artery

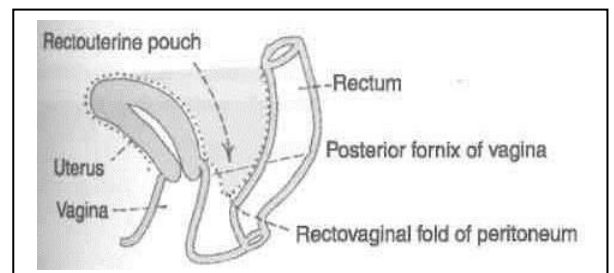


**Clinical Anatomy-Internal hernia** into the lesser sac can result through this foramen

## RECTOUTERINE POUCH

**Boundaries**It is bounded:

- Anteriorly**, by the **uterus** and the **posterior fornix** of the **vagina**.
- Posteriorly**, by the **rectum**
- Inferiorly (floor)** by the **rectovaginal fold of peritoneum**.



### CLINICAL ANATOMY

- **The floor of the pouch** is 5.5 cm from the anus.
- It can be **easily felt** with a **finger passed through the rectum or the vagina.**
- It is the most dependent part of the peritoneal cavity, **pus tends to collect here.**
- **The pouch** can be **drained** either **through the rectum** or through the **posterior fornix of the vagina.**

# THE STOMACH

## Definition

- The stomach is a **muscular bag** forming the **widest and most distensible** part of the **digestive tube**.

## Extent-

It is **connected above** to the **lower end of the oesophagus**, and **below** to the **duodenum**.

## Location

- The stomach **lies obliquely** in the **upper and left part of the abdomen**
- It is occupying the **epigastric, umbilical and left hypochondriac regions**.
- Most of it lies **under cover** of the **left costal margin and the ribs**

## Shape and Position

- When **empty**, the stomach is **somewhat J-shaped** (vertical);
- when **partially distended**, it becomes **pyriform** in shape.
- In **obese persons**, it is **more horizontal**.

**The shape of the stomach can be studied** in the living by radiographic examination after giving a barium meal.

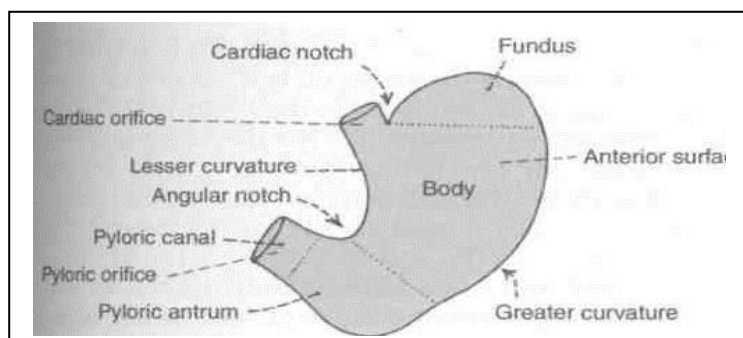
## Size

- It is about **25 cm.** Long.
- **the mean capacity is 30 ml at birth, 1 litre at puberty,** and **1.5 to 2 litres or more in adults.**

## External Features

The stomach has

- **2 orifices** or openings,
- **2 curvatures** or borders,
- **2 surfaces**



## Two Orifices

### The cardiac orifice

It is **joined** by the **lower end of the oesophagus**.

### The pyloric orifice

It opens into the **duodenum**.

### Two Curvatures

- The **lesser curvature** is **concave** and forms **the right border of the stomach**.
- It provides **attachment to the lesser omentum**.
- The **greater curvature** is **convex** and forms **the left border of the stomach**.
- It provides **attachment to the greater omentum**,

### Two Surfaces

The *anterior*

The *posterior*

### Two Parts Subdivided into Four

The stomach is divided into two parts.

#### 1. Cardiac and

#### 2. pyloric

- **Cardiac part** is further **subdivided into the fundus and body**,
- **Pyloric part** is subdivided into the **pyloric antrum** and the **pyloric canal**.

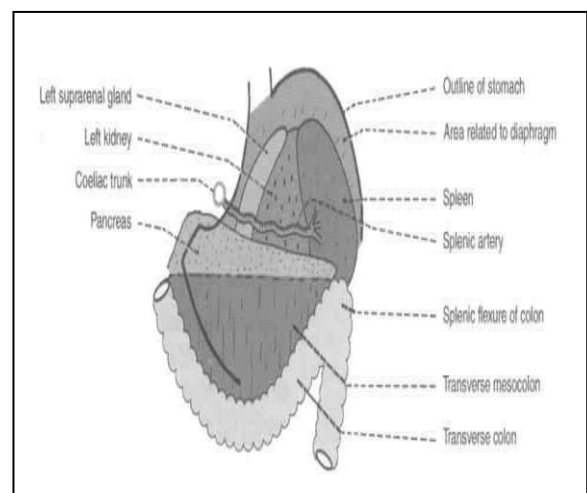
## STOMACH BED

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- The **posterior surface of the stomach is related to structures forming the stomach bed**.
- The structure forming stomach bed are separated from the stomach by the cavity of the lesser sac.

**These structures are :**

- (1) The diaphragm;
- (2) the left kidney;
- (3) the left suprarenal gland;
- (4) the pancreas;
- (5) the transverse mesocolon;





- (6) the splenic flexure of the colon; and
- (7) the splenic artery

**Sometimes the spleen is also included in the stomach bed.**

## BLOOD SUPPLY OF STOMACH

---

The stomach is supplied by:

- (1) **Left gastric artery**, a branch of **coeliac trunk**
- (2) **Right gastric artery**, a branch of **common hepatic artery**
- (3) **Right gastroepiploic artery**, a branch of **Gastroduodenal artery**
- (4) **Left gastroepiploic artery**, a branch of **Splenic artery**
- (5) **5 to 7 short gastric arteries**, which are **branches of splenic artery**

**The veins of the stomach drain** into the **portal, superior mesenteric and splenic veins**.

## LYMPHATIC DRAINAGE OF THE STOMACH

---

The stomach can be **divided into four lymphatic territories**

The drainage of these areas is as follows:

### **Area a, or pancreatico splenic area,**

**Upper part of left 1/3<sup>rd</sup> drains into the pancreaticosplenic nodes**

- Lymph vessels from these nodes travel  
Along splenic artery to reach coeliac nodes.

### Area B right upper 2/3<sup>rd</sup>

- drains into the **left gastric nodes**.
- Lymph from these nodes drains into the coeliac nodes.

### Area c lower part of left 1/3<sup>rd</sup>

- Drains into the **right gastroepiploic nodes**.
- Lymph vessels arising in these nodes drain into the **subpyloric nodes**
- From here the lymph is drained further into **the hepatic nodes**  
And **finally into the coeliac nodes**.

### area d pyloric part

- drains into different directions into the **pyloric, hepatic and left gastric nodes**,
- Lymph passes from all these nodes **to the coeliac nodes**.

Note that lymph from all areas of the stomach ultimately reaches the coeliac nodes.

From here it passes through the intestinal lymph trunk to reach the cisterna chyli.

## Nerve Supply

The stomach is supplied by sympathetic and parasympathetic nerves.

- The sympathetic **nerves** are derived from **thoracic six to ten segments of the spinal cord**
- **The parasympathetic nerves** are derived from **the vagus**

## Clinical Anatomy Of stomach

---

### Gastric pain

- **Gastric pain** is felt in the **epigastrium**.
- Because the stomach is supplied from **segments T6 to T10 of the spinal cord**.
- These segments also supply the **upper part of the abdominal wall**.

### Peptic ulcer

- *Peptic ulcer* can occur in the sites which exposed to **pepsin and hydrochloric acid**.
- In the stomach peptic ulcer is named as **Gastric ulcer**

### Gastric ulcer

- Gastric ulcer occurs **typically along the lesser curvature**.

### Gastric Carcinoma

- Gastric carcinoma is **common and occurs along the greater curvature**.
- **The lymphatic drainage of stomach** assumes importance.
- **Metastasis** can occur through the thoracic duct to the **left supraclavicular lymph node**.
- Its common in **blood group "A"**

### Investigations

#### Chemical.

- Gastric analysis (fractional test meal) is done chiefly to estimate the gastric acidity.

#### Radiological examination

- by the barium meal.

#### Endoscopic

- **It's called gastroscopy for stomach**.
- The interior of stomach can be **scanned under direct vision by endoscope**.

# THE DUODENUM

## Definition and Location

- The duodenum is the **widest and most fixed part** of the small intestine.
- It **extends** from the **pylorus** to the **duodenojejunal flexure**.

## length and Parts

**Duodenum is 25 cm long.**

It is divided into the following four parts.

- **First** or superior part, **5 cm long**.
- **Second** or descending part, **7.5 cm long**.
- **Third** or horizontal part, **10 cm long**.
- **Fourth** or ascending part, **2.5 cm long**.

## SECOND PART OF THE DUODENUM

Part of duodenum which **begins** at the **superior duodenal flexure** and **end** at the **inferior duodenal flexure**.

### **Course**

- This part is **about 7.5 cm long**.

**Its relations are as follows.**

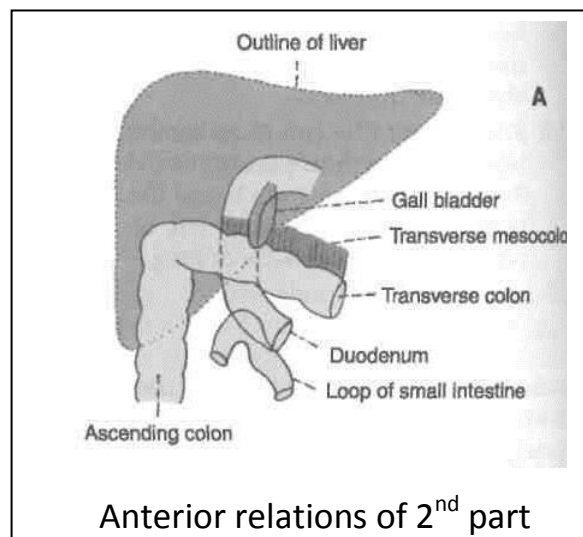
### Peritoneal Relations

- It is retroperitoneal and fixed.
- Its anterior surface is covered with Peritoneum.

### Visceral Relations

#### Anteriorly :

- Right lobe of the **liver**;
- **Transverse colon**,
- Root of the **transverse mesocolon**
- **Small intestine**

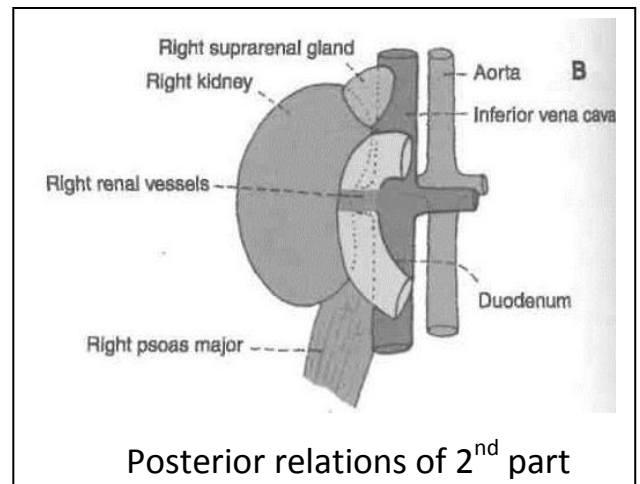


### Posteriorly:

- Anterior surface of the **right kidney** near the medial border,
- Right **renal vessels**,
- Right edge of the **inferior vena cava**,
- Right **psoas major**.

### Medially :

- Head of the **pancreas**
- the **bile duct**



### Laterally:

- Right **colic flexure**

The interior of the second part of the duodenum shows the following special features.

The **major duodenal papilla** is an elevation

- The **hepatopancreatic ampulla** opens in it.

The **minor duodenal papilla**

- presents the opening of the **accessory pancreatic duct**.

## Arterial Supply

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- **Upto the level of the hepatopancreatic ampulla opening**, the duodenum is supplied by the **superior pancreaticoduodenal artery**,
- Below opening duodenum supplied by the **inferior pancreaticoduodenal artery**.

## Venous Drainage

- The veins of the duodenum drain into the **splenic, superior mesenteric and portal veins**.

### Lymphatic Drainage

- **lymph** vessels from the duodenum end in the **pancreaticoduodenal nodes**

### Nerve Supply

- *Sympathetic nerves* from **thoracic ninth and tenth spinal segments**
- *parasympathetic nerves* from the vagus,

### Clinical anatomy

#### **Duodenal diverticula**

- They are seen along its concave border, generally at points where arteries enter the duodenal wall.

#### **Congenital stenosis and obstruction of the second part of the duodenum**

- may occur at **the site of the opening of the bile duct.**
- Other **causes of obstruction** is an **annular pancreas.**

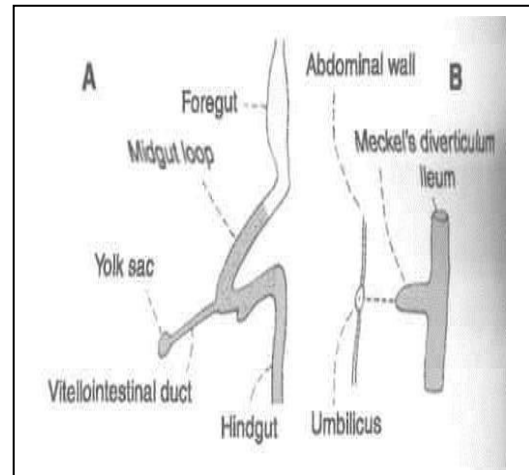
#### **X-ray**

- The x-ray taken **after giving a barium meal.**

## MECKEL'S DIVERTICULUM (DIVERTICULUM ILEI)

- **Meckel's diverticulum** occurs from the **persistent proximal part** of the **vitellointestinal duct**.
- **vitellointestinal duct** which normally disappears during the 6th week of intrauterine life.
- Some points of interest about it are as follows.

1. It occurs in **2% subjects**.
2. Usually it is **2 inches** or 5 cm long.
3. It is situated about **2 feet** or 60 cm **proximal to the ileocaecal valve**.
4. Its **calibre** is **equal to that of the ileum**.
5. Its **apex** may be **free** or **may be attached to the umbilicus**, to the **mesentery**, or to any **other abdominal structure by a fibrous band**.



### CLINICAL ANATOMY

Meckel's diverticulum may **cause intestinal obstruction**.

## VERMIFORM APPENDIX

### Definition

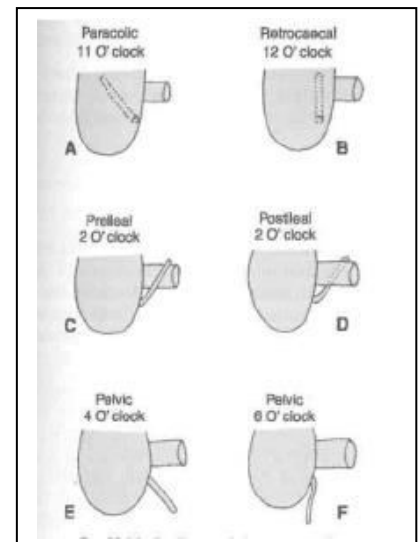
- This is a **worm-like diverticulum** arising from the **the caecum**

### Dimensions

- The length varies from **2 to 20 cm** with an **average of 9 cm**.
- It is **longer in children than in adults**.
- The **diameter** is about **5 mm**.

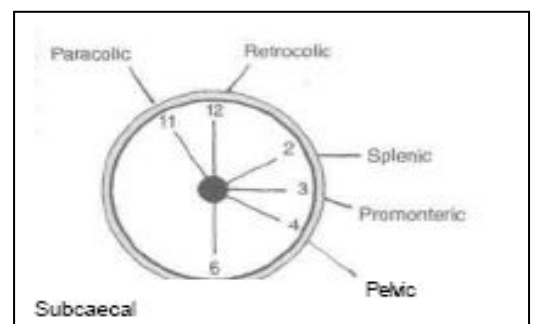
### Positions

- The appendix lies in the **right iliac fossa**.
- Although the **base of the appendix is fixed**,
- The **tip can point in any direction**.
- The positions are compared to clock



- paracolic or 11 O'clock position.
- It may lie **behind the caecum or colon**, known as retrocaecal or 12 O'clock position. This is the commonest position of the appendix, about 65%.
- The appendix may point towards the spleen. This is the **splenic or 2 O'clock position**.  
The appendix may lie in front of the ileum (**preileal**) or behind the ileum (**postileal**).

- It may point to the sacral promontory called promontoric or **3 O'clock position**.
- It may descend into the pelvis called **pelvic or 4 O'clock position**.  
**This is the second most common position about 30%.**



- It may point towards the inguinal ligament called as midinguinal or **6 O'clock position**.



### **Appendicular Orifice**

- The appendicular situated on the **posteromedial aspect** of the **caecum 2 cm below the ileocaecal orifice**.

### **Lumen of Appendix**

- It is **quite small** and **may be partially or completely obliterated** after mid-adult life.

### **Peritoneal Relations**

- The appendix is suspended by peritoneum, called the **mesoappendix**.

**Blood Supply** - The **appendicular artery supplies appendix**.

### **Nerve Supply**

- **Sympathetic nerves** are derived from **thoracic nine and ten segments** of spinal cord.
- **Parasympathetic nerves** are derived from the **vagus**.

### **Lymphatic Drainage**

- **lymphatics** drains into the **ileocolic nodes, appendicular nodes**.

## **CLINICAL ANATOMY**

---

### **Appendicitis**

**Inflammation of the appendix is known as appendicitis.**

### **Appendicectomy.**

The **operation for removal of the appendix** is called **appendicectomy**.

**McBurney's point** is the site of **maximum tenderness in appendicitis**.

- The point lies at the junction of the lateral one-third and the medial two-thirds of the line joining the umbilicus to the right anterior superior iliac spine.

## PORTOSYSTEMIC COMMUNICATIONS (PORTOCAVAL ANASTOMOSIS)

---

These communications form important routes of collateral circulation in portal obstruction.

The following are the important sites of portosystemic communications.

### 1. Umbilicus:

- The **paraumbilical veins** from **left branch of the portal vein** **Anastomoses with veins of the anterior abdominal wall.**
- In **portal obstruction** the veins around the umbilicus **enlarge** forming the ***caput medusae***.

### 2. Lower end of oesophagus:

Oesophageal tributaries of the **left gastric vein** (portal) **anastomose with**

Oesophageal tributaries of the **accessory hemiazygos vein** (systemic).

### 3. Anal canal:

The **superior rectal vein** (portal) **anastomoses with**  
the **middle and inferior rectal veins** (systemic)

### 4. Bare area of the liver

**Hepatic venules** (portal) **anastomose with**  
the **phrenic and intercostal veins** (systemic).

### 5. Posterior abdominal wall:

**Veins of retro-peritoneal organs**, like the duodenum, the ascending colon and the descending colon (portal) **anastomose with the**  
**retroperitoneal veins of the abdominal wall** and of the renal capsule (systemic).

### 6. Liver:

Rarely, the **ductus venosus** remains patent and **connects the left branch of the portal vein directly to the inferior vena cava.**

### CLINICAL ANATOMY

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#### **Portal pressure:**

Normal pressure in the portal vein is about 5-15 mm Hg.

#### **Portal hypertension** (pressure above 40 mm Hg):

It can be caused by the following:

- Cirrhosis of liver, in which the vascular bed of liver is markedly obliterated

It cause

- **Congestive splenomegaly,**
- Ascites, and
- Collateral circulation through the porto-systemic communications.
- It forms
  - (i) **Caput medusae** around the umbilicus
  - (ii) **oesophageal varices** at the lower end of oesophagus which may rupture and cause dangerous or even fatal haematemesis; and
  - (iii) **haemorrhoids** in the anal canal may be responsible for repeated bleeding per rectum.

## ISCHIORECTAL FOSSA

---

The ischiorectal fossa is a wedge-shaped space situated one on each side of the anal canal below the pelvic diaphragm.

### Dimensions

Length- 5cm ,

Width- 2.5 cm,

Depth- 5 cm

### Boundaries

**Base** is formed by the skin.

**Apex** is formed by the line where the **obturator fascia** meets the **inferior fascia of the pelvic diaphragm**.

**Anteriorly** - perineal membrane

**Posteriorly** - gluteus maximus

**lateral wall** - formed by:

(a) **obturator internus with the obturator fascia**

(b) medial surface of the **ischial tuberosity**

**Medial wall** is formed by :

(a) **External anal sphincter**, with the **fascia covering** it in the lower part;

(b) **Levator ani with the anal fascia** in the upper part

### Contents of Ischiorectal Fossa

1. Ischiorectal pad of fat.
2. Inferior rectal nerve and vessels.
3. Posterior scrotal or posterior labial (in females) nerves and vessels
4. Perineal branch of the fourth sacral (S4) nerve.
5. Perforating cutaneous branches of nerves S2, S3.
6. Pudendal canal with its contents.

## CLINICAL ANATOMY

---

1. The two ischiorectal fossae **allow distention of the rectum and anal canal during passage of faeces.**

### 2. Abscesses

Both the perianal and ischiorectal spaces are common sites of **abscesses**.

- Sometimes an abscess may burst into the anal canal or rectum internally, and on to the surface of the perineum externally.
- In this way an ischiorectal type of **anorectal fistula or fistula in ano** may be **produced**

3. The ischiorectal fat acts as a **cushion-like support to the rectum and anal canal**.

- Loss of this fat in some diseases like diarrhoea in children may result in prolapse of the rectum.

## SUPPORTS OF THE UTERUS

---

- The uterus is a **mobile organ**.
- It undergoes **extensive changes in size and shape** during the reproductive period of life.
- It is supported and prevented from going down by a number of factors which are chiefly muscular and fibromuscular.

### Primary Supports

#### A. Muscular or active supports

1. Pelvic diaphragm
2. Distal urethral sphincter mechanism
3. Perineal body

#### B. Fibromuscular or mechanical supports

1. Pubocervical ligaments
2. Uterosacral ligaments
3. Transverse cervical ligaments of Mackenrodt
4. Uterine Axis
5. Round ligaments of uterus.

### Secondary Supports

These are formed by peritoneal ligaments-

1. Rectovaginal fold of peritoneum
2. Uterovesical fold of peritoneum
3. Broad ligaments

### Role of Individual Supports

#### Pelvic Diaphragm

- The **pelvic diaphragm** supports the pelvic viscera and resists any rise in the intra-abdominal pressure.
- The **pubococcygeus part** of the levator ani is partly inserted into the perineal body between the vagina and the rectum.

- Some of these fibres also **form a supporting sling and a sphincter for the vagina, and so indirectly for the uterus** and the urinary bladder.

### Perineal Body

- It is a fibromuscular node to which ten muscles are attached.
- It acts as an **anchor for the pelvic diaphragm**, and thus **maintains the integrity of the pelvic floor**.

### Distal urethral sphincter

- The sphincter urethrae muscle chiefly forms the external sphincter of the urethra.
- Many inferior fibres of the muscle support the vagina by getting attached to its walls

### Uterine Axis

- The **anteverted position of the uterus** itself prevents the organ from sagging down through the vagina.
- **Any rise in intra-abdominal pressure tends to push the uterus against the bladder and pubic symphysis.**
- The **angle of anteversion** is maintained by the uterosacral and round ligaments

### Pubocervical Ligaments

- These ligaments connect the pubis to cervix and support the uterus.

Transverse Cervical Ligaments of Mackenrodt

- They connect the cervix to the pelvic wall that supports the uterus

### Uterosacral Ligaments

- They **connect the cervix to the sacrum(S2, S3)**
- The uterosacral ligaments **keep the cervix pulled backwards against the forward pull of the round ligaments.**
- Uterosacral and round ligaments form a couple that maintains the uterine axis

### Round Ligaments of Uterus

- The round ligaments are **two fibromuscular flat bands**, 10 to 12 cm long.
- The round ligament **keeps the fundus pulled forwards** and maintains the angle of anteversion against the backward pull of the uterosacral ligaments

### CLINICAL ANATOMY

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#### 1. Retroverted uterus

- In some cases the uterus comes to lie in straight line with the vagina.  
This is called a *retroverted uterus*

#### 2. Prolapse of the uterus

- Sometimes the uterus passes downwards into the vagina.
- The condition is called *prolapse of the uterus*.
- It is caused by weakening of the various supports of the uterus.



## ANAL CANAL

---

The anal canal is the **terminal part of the large intestine**.

### Situation

- Anal canal is situated below the level of the pelvic diaphragm.
- It lies between the right and left ischiorectal fossae

### Length, Extent and Direction

- The anal canal is **3.8 cm long**.
- It extends from the **anorectal junction to the anus**.
- It is **directed downwards and backwards**.
- **The anal canal is surrounded by inner involuntary and outer voluntary sphincters which keep the lumen closed**

### Relations of the Anal Canal

---

#### Anteriorly

- In both sexes : **perineal body**,
- In males : membranous urethra and bulb of penis,
- In females : lower end of the vagina

#### Posteriorly

- Anococcygeal ligament; and
- Tip of the coccyx

#### Laterally

- Ischiorectal fossae

#### All round

- Anal canal is **surrounded by the sphincter muscles**, the tone of which keeps the canal closed.

### Interior of the Anal Canal

It can be divided into three parts:

- Upper part, about 15 mm long;
- Middle part, about 15 mm long;
- Lower part about 8 mm long.

### Upper Mucous Part

- This part is about 15 mm long. It is lined by mucous membrane

The mucous membrane shows

- 6 to 10 vertical folds; these folds are called the **anal columns of Morgagni**.
- The lower ends of the anal columns are united to each other by short transverse folds of mucous membrane; these folds are called the **anal valves**
- Above each valve there is a depression in the mucosa which is called the **anal sinus**.
- The anal valves together form a transverse line that runs all round the anal canal. This is **the pectinate line**.

### **Middle Part or Transitional Zone or Pecten**

- **The next 15 mm** or so of the anal canal is also lined by mucous membrane.
- The mucosa has a **bluish appearance** because of a **dense venous plexus that lies between it and the muscle coat**.
- This region is referred to as the ***pecten or transitional zone***.
- The **lower limit of the pecten** often has a whitish appearance because of which it is referred to as the **white line of Hilton**.

### **Lower Cutaneous Part**

- It is about **8 mm long** and is lined by true **skin containing sweat and sebaceous glands**.
- The epithelium of the lower part **resembles that of true skin**.

### **Musculature of the Anal Canal *Anal Sphincters***

#### **The internal anal sphincter**

- It is involuntary in nature.
- It is smooth muscle.
- It surrounds the upper three-fourths, i.e. 30 mm of the anal canal.

#### **The external anal sphincter**

- It is under voluntary control.
- It is made up of a striated muscle.
- It surrounds the whole length of the anal canal.

#### **Arterial Supply**

- The part of the anal canal above the pectinate line is supplied by the **superior rectal artery**.

- The part below the pectinate line is supplied by the **inferior rectal artery**.

### Venous Drainage

#### 1. The internal rectal venous plexus

- It lies in the **submucosa of the anal canal**
- Veins present in the three anal columns situated at **3, 7 and 11 O'clock positions** as seen in the lithotomy position.
- They are **large and constitute potential sites** for the **formation of primary internal piles**.

#### 2. The external rectal venous plexus

- It lies **outside the muscular coat** of the rectum and anal canal.
- It **communicates** freely with the internal plexus.

### Nerve Supply

- **Above the pectinate line**
  - anal canal is supplied by **autonomic nerves**, both sympathetic and parasympathetic
- **Below the pectinate line**
  - It is supplied by somatic [inferior rectal] nerves.

### Sphincters

- The internal sphincter is contracted by sympathetic nerves and relaxed by parasympathetic nerves.
- The external sphincter is supplied by the inferior rectal nerve.

## CLINICAL ANATOMY

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### Anal Fissure/Fissure in Ano

- Anal fissure is caused by the **rupture of one of the anal valves**,
- usually by the passage of dry hard stool in a constipated person
- Because of the involvement of skin the **condition is extremely painful**.

### Fistula in Ano

A fistula is an **abnormal epithelialised track** connecting two cavities, or one cavity with the exterior.

## PILES OR HEMORRHOIDS

---

### *Internal piles or true piles*

- **Internal piles are** dilatations of the internal rectal venous plexus.
- They occur above the pectinate line.
- They are painless.
- **They bleed more during straining at stool.**
- The **primary piles occur in 3, 7 and 11 O'clock** positions of the anal wall when viewed in the lithotomy position.
- They are formed by enlargement of the radicles of the superior rectal vein which lie in the anal columns
- Varicosities in other positions of the lumen are called *secondary piles*.

The various *factors* responsible for causing internal piles are:

- **Poor support to veins from the surrounding loose connective tissue,**
- **absence of valves** in the superior rectal and portal veins;
- **Direct transmission of the increased portal pressure** at the portosystemic communications.
- For these reasons the development of piles is favoured by **constipation, prolonged standing, excessive straining at stool, and portal hypertension.**

### External piles or false piles

- It occurs **below the pectinate line** and are,
- therefore, **very painful.**
- **They do not bleed on straining at stool.**

## RELATIONS OF THE KIDNEYS

---

- The kidneys are retroperitoneal organs.
- partly covered by peritoneum anteriorly.

### **Relations Common to the Two Kidneys**

- The upper pole of each kidney is related to the corresponding suprarenal gland.
- The lower poles lie about 2.5 cm above the iliac crests.

### **The medial border of each kidney is related to**

- (1) the suprarenal gland, above the hilus
- (2) the ureter below the hilus.

### **The posterior surfaces of both kidneys are related to**

- (1) The diaphragm;
- (2) the medial and lateral arcuate ligaments;
- (3) the psoas major;
- (4) the quadratus lumborum;
- (5) the transversus abdominis;
- (6) the subcostal vessels

In addition, the right kidney is related to twelfth rib, and the left kidney to eleventh and twelfth rib.

### **The structures related to the hilum**

The following structures are seen in the hilum from **anterior to posterior side**: (1)

The renal vein

- (2) the renal artery, and
- (3) the renal pelvis, which is the expanded upper end of the ureter.

### **Other Relations of the Right Kidney**

Anterior Relations

- (1) Right suprarenal gland,
- (2) liver,
- (3) second part of duodenum,
- (4) hepatic flexure of colon, and
- (5) small intestine.

- The lateral border of the right kidney is related to the right lobe of the liver and to the hepatic flexure of the colon

### **Other Relations of the Left Kidney**

#### Anterior Relations

- (1) Left suprarenal gland,
- (2) spleen,
- (3) stomach,
- (4) pancreas,
- (5) splenic vessels,
- (6) splenic flexure and descending colon, and
- (7) jejunum.

- The lateral border of the left kidney is related to the spleen and to the descending colon.

# Lower Limb

## WRITE A SHORT NOTE ON FEMORAL TRIANGLE.

It's a triangular shape. It's situated in upper 1/3 rd of thigh.

### Boundaries-

**Laterally-** By medial border of Sartorius

**Medially-** By medial border of adductor longus

**Base-** is formed by inguinal ligament

**Apex-** is formed by the point where medial and lateral boundaries meet

**Apex is continuous below with th adductor canal.**

### Roof-

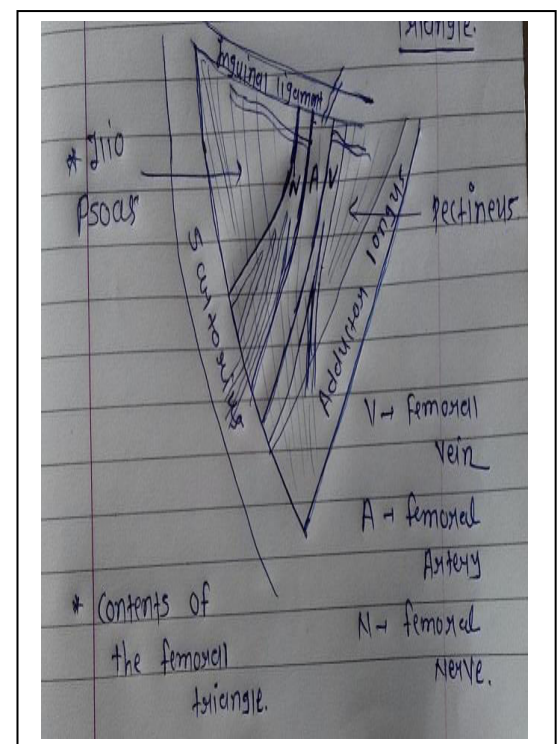
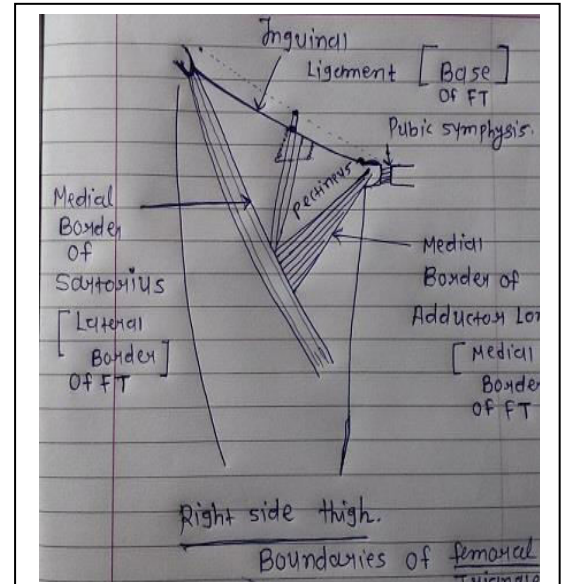
- skin
- **Superficial fascia** -containing superficial inguinal lymphnodes, branches of femoral artery with veins, and upper part of great saphenous vein.
- **Deep fascia**- with saphenous opening and cribriform fascia

### Floor- a-p-p-i

Medial to lateral by adductor longus---pectineus---psoas major---iliacus.

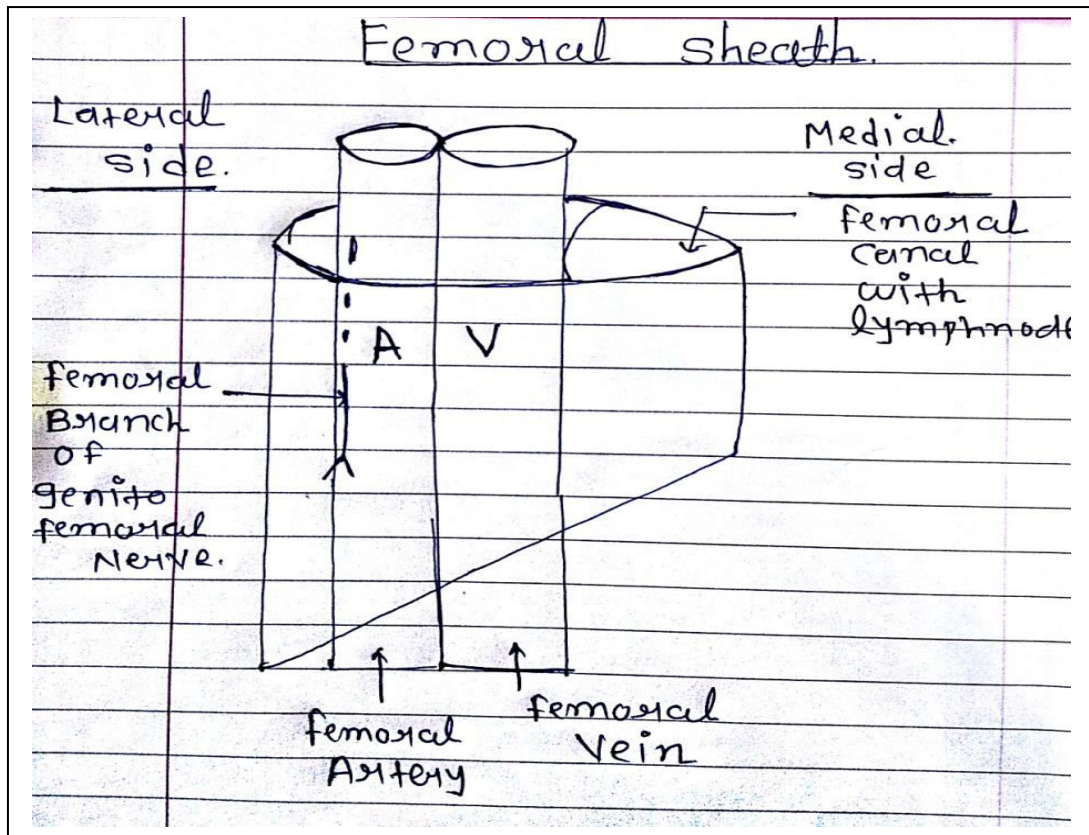
### Contents-

1. **Femoral artery** and its branches
2. **Femoral vein** and its tributaries
3. **Femoral sheath** covering upper 4 cm of femoral vessels
4. **Nerves**
  - a] femoral nerve- lateral to femoral artery
  - b] nerve to pectineus
  - c] femoral branch of genitofemoral nerve
  - d] lateral cutaneous nerve of thigh
5. **Deep inguinal lymph nodes.**





## WRITE A SHORT NOTE ON FEMORAL SHEATH.



### Shape of sheath is funnel type

It is prolongation of fascia around proximal part of femoral vessels. Enclosing Upper 3 to 4 cm of femoral vessels.

**Site-** situated in the femoral triangle below inguinal ligament

**Formed by** downward extension of two layers of fascia of abdomen.

**Anterior wall** by – fascia transversalis

**Posterior wall** by – fascia iliaca.

Inferiorly- sheath merge with connective tissue around vessels.

**Lateral wall** is vertical

**Medial wall** is oblique and directed downward and laterally

The sheath is divided into the three compartments by septa

**Lateral compartment-** it contains **femoral artery** and **femoral branch of genitofemoral nerve**

**Intermediate compartment-** it contains **femoral vein**

**Medial compartment-** it is the smallest of all.

It is known as **femoral canal**.

## FEMORAL CANAL

---

[ Draw the diagram of above short note]

**This is the medial compartment of femoral sheath**

**Shape** – conical

**Dimensions-** it is wide at base and narrow below. About 1.5 cm long and 1.5 cm wide at base.

**Base-** also known as **femoral ring**

It is the upper end of femoral canal. It is wider.

This is a weak point in lower abdomen and it is the site for femoral hernia.

**content-** femoral canal contains lymph node of cloquet, lymphatics and small amount of areolar tissue.

Thus femoral canal is the space in the femoral sheath and femoral ring is the upper end of the femoral canal

### **SQ-Femoral Ring**

**The base or upper end of femoral canal is called femoral ring**

Boundaries-

**Anteriorly-** by inguinal ligament

**Posteriorly** – by pectineus and its covering fascia

**Medially** by the concave margin of lacunar ligament

**Laterally** by the septum separating it from femoral vein

**Femoral septum-** the femoral ring is closed by a condensation of extraperitoneal connective tissue called as femoral septum

**Femoral fossa** parietal peritoneum covering femoral septum from above shows a depression called as femoral fossa.

## FEMORAL HERNIA

---

**Hernia-** is abnormal swelling due to the normal content of body which protrude out with their coverings

**Femoral canal** is an area of potential weakness in the lower abdominal wall so abdominal content pass from it and they reach there and produce swelling.

**Mostly the content is bowel loop.**

**Course-**First it passes downwards through femoral canal → forwards through saphenous opening → finally upwards along with superficial epigastria and superficial circumflex iliac vessels.

### For reduction of hernia

**The reverse course has to be followed.**

### SQ-Femoral hernia is more common in Females than males.

- Because femoral canal is wider in females.
- Femoral canal is wider in females because females have wider pelvis than males. And smaller size of femoral vessels
- femoral ring is the entry site for femoral hernia

## Complication of hernia

### **Obstructed hernia-**

When the content of hernia sac can't go back to their original position known as obstructed hernia

### **Strangulated hernia-**

when blood supply of content of hernia is also impaired, it's known as strangulated hernia

- **For hernia repair surgery is done**
- **In surgical process contents are pushed back following the reverse route.**

## **ADDUCTOR CANAL/ HUNTER'S CANAL/ SUBSARTORIAL CANAL**

---

Adductor canal is an **intramuscular space** situated on the medial side and middle one third of thigh.

**Extent-** Above from apex of the femoral triangle to Below tendinous opening in the adductor magnus muscle.

**Shape-** the canal is triangular on cross-section.

### **Boundries**

**Anterior wall** – is formed by vastus medialis

**Posterior wall [floor]-** is formed by above- adductor longus and below by- adductor magnus

**Medial wall [roof]** – is formed by strong fibrous membrane joining the anterior and posterior walls.

**It is overlapped by Sartorius**

Sabsartorial plexus of nerves lies on the fibrous roof of the canal and under Sartorius This plexus is formed by- branches from [1] medial cutaneous nerve of thigh [2] saphenous nerve [3] anterior division of obturator nerve

### **Content**

#### **artery**

- Femoral artery which gives muscular branches and descending genicular artry
- Femoral artry leaves canal through hitus magnus and continue as poplital artry

#### **Vein**

- Femoral vein
- Femoral vein is a continuation of poplital vein

#### **Nerve**

- Saphenous Nerve  
Saphenous nerve is the longest cutaneous nerve.It's a branch of femoral N
- Nerve to Vastus medialis and obturator nerve's branches

### **Clinical anatomy**

- operation for the **treatment of poplital aneurism** is done by **ligating** the **femoral artery in the adductor canal**

## OBTURATOR NERVE

---

It's the **main nerve of Medial Compartment of Thigh.**

### Origin and Root value-

Ventral divisions of the ventral primary rami of spinal nerve **L2, L3, L4**

### Course and division

- It emerges at the medial border of psoas major muscle then descends down lying on the lateral wall of true pelvis
- Enters thigh by passing from obturator foramen
- Within the obturator canal nerve divides into **anterior and posterior division**

### Supply

#### Anterior Division supplies

- Pectineus
- Adductor longus
- Gracilis
- Adductor brevis if not supplied by the posterior division
- Gives branch to subsartorial plexus
- Hip joint
- Ends by supplying the femoral artery

#### Posterior Division supplies

- Obturator externus
- Adductor magnus
- Adductor brevis if not supplied by the anterior division
- **Genicular branch** which enters the popliteal fossa then **supplies capsule and cruciate ligaments of knee joint**
- Some fibers supply popliteal artery

### Clinical anatomy

**Referred pain** – a **disease in the hip joint** may cause referred **pain in the knee** and on the medial side of the thigh.

**Because of common nerve supply by the obturator nerve**

**Spastic paraplegia** may involve adductor muscles and it creates **spasm** of the adductor muscles.

## POPLITAL FOSSA

Popliteal fossa is a **diamond shaped depression** lying behind the knee joint.

In relation to lower part of femur and upper part of tibia.

### Boundries

**Superolaterally**- Biceps femoris

**Superomedially**- Semitendinosus,

semimembranosus mainly

Gracilis, Sartorius and adductor magnus also

**Inferolaterally**- Lateral head of gastrocnemius

mainly and plantaris

**Inferomedially** – Medial Head of gastrocnemius

### Roof –

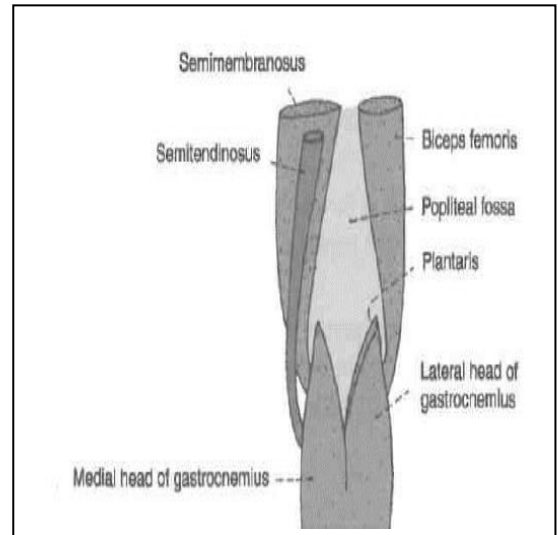
- deep fascia or popliteal fascia
- Superficial fascia which contains small saphenous Vein
- cutaneous nerves

### Floor-

- Popliteal surface of the femur,
- Capsule of the knee joint,
- Oblique popliteal ligament,
- Strong popliteal fascia covering popliteus muscle

### Contents of the fossa

- Popliteal artery and its branches
- Popliteal vein and its tributaries
- The tibial nerve and its branches
- Common peroneal nerve and its branches
- Posterior cutaneous nerve of the thigh
- Genicular branch of the obturator nerve
- Popliteal lymph nodes
- Fat



## **CLINICAL ANATOMY**

1. **Blood pressure** in the lower limb is recorded **from the popliteal artery**.
2. Constant palpation of the popliteal artery may **cause changes in the vessel wall**, leading to narrowing and **occlusion of the artery**.
3. **The Popliteal artery** is more prone to **aneurysm** than many other arteries of the body.

## DORSALIS PEDIS ARTERY

---

### Introduction and Origin

- This is the **chief artery of the dorsum of the foot.**
- It is a **continuation of the anterior tibial artery** on to the dorsum of the foot.

### Course

- The artery begins in **front of the ankle between the two malleoli.**
- It passes forwards along the medial side of the dorsum of the foot to **reach the proximal end of the first intermetatarsal space**
- Here it **dips downwards**, ends in the **sole by completing plantar arterial arch.**

### Relations

#### *Superficial:*

- Skin, fasciae, and extensor retinaculum.

#### *Deep:*

- **Capsular ligament** of the ankle joint.
- The **talus, navicular** and **intermediate cuneiform** bones.

#### *Medial:*

- **Extensor hallucis longus.**

#### *Lateral*

- First tendon of the **extensor digitorum longus.**

### Branches

1. **The lateral tarsal artery**
2. **The medial tarsal branches**
3. **The arcuate artery**
  - It gives off the **second, third and fourth dorsal metatarsal arteries**
4. **The first dorsal metatarsal artery**
  - It gives a branch to the medial side of the big toe.

### CLINICAL ANATOMY

**Pulsations** of the dorsalis pedis artery are easily felt **between** the tendons of the **extensor hallucis longus** and the **first tendon of the extensor digitorum longus.**

- **dorsalis pedis** artery is **congenitally absent** in about **14% of subjects.**
- It is commonly palpated in patients with **vaso-occlusive diseases** of the lower limb.



## WHAT IS GUY ROPES

---

- The **three muscles** inserted into the upper part of the **medial surface of tibia**
- represent **one muscle from each of the three compartments** of thigh
- ***Sartorius*** belongs to **anterior compartment of thigh**,
- ***gracilis*** belongs to **medial compartment of thigh**,
- ***Semitendinosus*** belongs to **posterior compartment of thigh**
- These three muscles are reaching below at one point, and spread out above towards pelvis, like three strings of a tent.

From this arrangement it appears that **they act as "guy ropes"**, to **stabilize the bony pelvis on the femur**

## Anserine bursa.

- This is a large **bursa**, with several diverticula.
- It separates **the tendons of sartorius, gracilis and semitendinosus** at their insertion from one another, **from the bony surface of tibia, and from the tibial collateral ligament**

## COMMON PERONEAL NERVE

---

This is the smaller terminal branch of the sciatic nerve

**Root Value:** (L4, L5, S1, S2)

### **Course**

- It **extends** from the **superior angle of the popliteal fossa** to the lateral angle, along the medial border of the biceps femoris.
- Continuing downwards and forwards.
- it winds around the **posterolateral aspect of the neck of the fibula**, **pierces the peroneus longus**, and divides into the superficial and deep peroneal nerves.

### **Branches**

**Cutaneous branches are two:**

- Lateral cutaneous nerve of the calf
- Peroneal communicating nerve

### **Articular Branches**

- Superior lateral genicular nerve.
- Inferior lateral genicular nerve
- Recurrent genicular nerve
- ❖ common peroneal nerve divides **into superficial and deep peroneal nerves.**
  - **superficial peroneal supplies evertors of the foot and**
  - **deep peroneal supplies dorsiflexors**

**Muscular branches do not arise from this nerve.**

However, it may give branch to the **short head of biceps femoris.**

### **Clinical Anatomy**

- The common peroneal nerve **can be palpated** against the **posterolateral side of the neck of the fibula.**
- It may be injured in this area.
- It can get injured easily by a **stick blow** on the **posterolateral aspect of neck of the fibula.**
- **Dorsiflexion and eversion** are lost. This condition is called "Foot drop".
- **It is the most frequently injured nerve in the lower limb.**

## PLANTAR ARCH

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Plantar arch is formed by the direct continuation of the lateral plantar artery, and is completed medially by the dorsalis pedis artery.

- The arch is slightly curved with its convexity directed forwards.

### Course

- It extends from the base of the fifth metatarsal bone to the proximal part of the first inter metatarsal space,
- It lies between third and fourth layers of the sole.

### Branches of the Plantar Arch

1. **Four plantar metatarsal arteries** run distal one in each intermetatarsal space.
  - Each artery enter by dividing into two *plantar digital* branches for adjacent sides of two digits.
  - The first artery also gives off a branch to the medial side of the great toe.
  - The lateral side of the little toe gets a direct branch from the lateral plantar artery.
2. The plantar arch gives off **three proximal perforating arteries** that pass through the second, third and fourth intermetatarsal spaces and **communicates** with the **dorsal metatarsal arteries** which are the branches of the arcuate artery.
3. The distal end of each plantar metatarsal artery gives off a **distal perforating artery** which joins the **distal part of the corresponding dorsal metatarsal artery.**

## GREAT /LONG SAPHENOUS VEIN

---

This is the largest and longest superficial vein of the lower limb

### Formation, course and Termination

- It begins on the **dorsum of the foot** from the **medial end of the dorsal venous arch**,
- Runs upwards in front of the **medial malleolus**, along the medial side of the leg,
- and **behind the knee**.
- **In the thigh**, it goes upward, forwards to **reach the saphenous opening**
- where it pierces the **cribriform fascia**
- and **opens into the femoral vein**.
- Before piercing the cribriform fascia, it receives **three named tributaries corresponding to the three cutaneous arteries**, and also many unnamed tributaries

### Characteristic

- It contains about **10 to 15 valves** which prevent back flow of the venous blood, which tends to occur due to gravity.
- Incompetence of these valves makes the vein dilated and tortuous leading to **varicose veins**.

### Connection

- The vein is also connected to the **deep veins of the limb by perforating veins**.
- The **perforating veins** are also provided with valves which permit flow of blood only from the superficial to the deep veins.
- failure of these valves also gives rise to **varicose veins**

### Clinical Anatomy

#### Varicose veins and ulcers.

- If the valves in the perforating veins or at the termination of the superficial veins become incompetent, the defective veins become "high pressure leaks"

- Through which the high pressure of the deep veins produced by muscular contraction and it is transmitted to the superficial veins.
- This results in **dilatation of the superficial veins** Known as **varicose Vein**
- Gradual degeneration of their walls producing **varicose ulcers**.

### "Calf pump" and "Peripheral heart".

- In the **upright position** of the body, the **venous return** from the lower limb **depends largely on the contraction of calf muscles**.
- These muscles are, therefore, known as the **"calf pump"**.
- For the same reason the **soleus** is sometimes called the **peripheral heart**.
- **Sinuses are present in soleus**
- **When the muscle relaxes**, blood flows into the sinuses from *the* superficial veins.
- **When this muscle contracts**, blood from sinuses pumped into the deep veins.
- **Unidirectional blood flow is maintained by the valves in the perforating veins.**

### Trendelenburg test.

- This is done to find out the **site of leak or defect** in a patient **with varicose veins**.
- Only the superficial veins and the perforating veins can be tested, **not the deep veins**.

#### Procedure

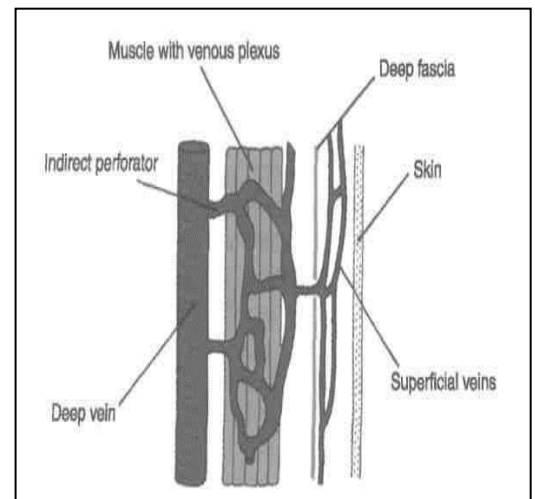
- The patient is **made to lie down**, and the **veins are emptied by raising the limb** and stroking the varicose veins in a proximal direction.
- Now pressure is applied with the **thumb** at the **saphenofemoral junction**, and the patient is asked to **stand up quickly**.

To test the superficial veins, the pressure is released.

- **Quick filling of the varicose veins from above indicates incompetency of the superficial veins.**

To test the perforating veins,

- The pressure at the saphenofemoral junction is not released, but maintained for about a minute.
- **Gradual filling of the varices indicates incompetency of the perforating veins**, allowing blood to pass from deep to superficial veins.



## HIP JOINT

---

### Ball and socket variety of synovial joint

- The head of the femur articulates with the **acetabulum** of the hip bone to form the hip joint.
- The hip joint is **unique** in having a **high degree of stability** as well as mobility.

### Ligaments

- Fibrous capsule,
- Iliofemoral ligament
- Pubofemoral ligament,
- Ischiofemoral ligament,
- Ligament of the head of the femur,
- Acetabular labrum, and
- Transverse acetabular ligament.

### Relations

#### Anterior relations

- Tendon of the iliopsoas

#### Posterior Relations

- obturator internus and gemelli,
- piriformis,
- **gluteus maximus muscle.**

#### Superior Relations

- Reflected head of the rectus femoris covered by the **gluteus minimus, gluteus medius**

#### Inferior Relations

- Lateral fibres of the **pectineus** and
- **obturator externus.**
- In addition there are gracilis, **adductors longus, brevis, magnus** and **hamstring muscles.**

#### Blood Supply

The hip joint is supplied by the **obturator artery, two circumflex femoral and two gluteal arteries.**

**Table 12.1: Muscles producing movements at the hip joint**

<i>Movement</i>	<i>Chief muscles</i>	<i>Accessory muscles</i>
1. Flexion	Psoas major and iliacus	Pectineus, rectus femoris, and sartorius; adductors (mainly adductor longus) participate in early stages.
2. Extension	Gluteus maximus and hamstrings	—
3. Adduction	Adductors longus, brevis and magnus	Pectineus and gracilis
4. Abduction	Glutei medius and minimus	Tensor fasciae latae and sartorius
5. Medial rotation	Tensor fasciae latae and the anterior fibres of the glutei medius and minimus	
6. Lateral rotation	Two obturators, two gemelli and the quadratus femoris	Piriformis, gluteus maximus and sartorius

## **CLINICAL ANATOMY**

The region of the hip joint is commonly affected by disease or injury.

### **Congenital dislocation**

- **Congenital dislocation** is more common in the hip
- The head of the femur slips upwards on to the gluteal surface
- **This causes lurching gait, and Trendelenburg's test is positive.**

### **Coxa vera**

- **Coxa vera** is a condition in which the **neck-shaft angle** is reduced from the normal angle

### **Osteoarthritis**

- **Osteoarthritis** is a disease of old age, **characterized by growth of osteophytes at the articular ends,**
- **which make movements limited and painful.**

### **Injuries:**

#### **Dislocation of the hip**

- **Dislocation of the hip** may be **posterior**, anterior or central.
- The sciatic nerve may be injured in posterior dislocations.

#### **Fracture of the neck of the femur**

- ***Fracture of the neck of the femur*** may be subcapital, near the head, cervical in the middle, or basal near the trochanters.
- These fractures are common in **old age**, between the **age of 40 and 60 years**.
- Femur-neck-fracture is usually **produced by trivial injuries**.

### Referred pain

Disease of the hip may cause *referred pain* in the knee because of the common nerve supply of the two joints.



## LOCKING AND UNLOCKING OF THE KNEE JOINT

---

### Locking

Locking is a mechanism that allows the knee to remain in the **position of full extension** as in **standing without much muscular effort**.

- Locking occurs as a result of **medial rotation of the femur** during **the last stage of extension**.
- The **anteroposterior** diameter of the **lateral femoral condyle** is less than **that of the medial condyle**.
- As a result, when the lateral condylar articular surface is fully 'used up' by extension, **part of the medial condylar surface remains unused**.
- At this stage the **lateral condyle serves as an axis** around which the **medial condyle rotates backwards**, i.e.
- medial rotation of the femur occurs, so **that the remaining part of the medial condylar surface is also 'taken up'**.
- This movement locks the knee joint.
- Locking is aided by the oblique pull of ligaments during the last stages of extension.
- **When the knee is locked, it is completely 'rigid and all ligaments of the joint are taut.**
- Locking is produced by continued action of the same muscles that produce extension, i.e. **the quadriceps femoris mainly vastus medialis**
- The locked knee joint can be flexed only after it is unlocked by **a reversal of the medial rotation, i.e. by lateral rotation of the femur.**

### Unlocking

Its lateral rotation of femur on fixed tibia at the starting of flexion of knee joint.

It is done by **popliteus muscle**.

## INVERSION AND EVERSION OF THE FOOT

---

### Inversion

**Inversion** is a movement in which **the medial border of the foot is elevated**, so that the **sole faces medially**.

- Inversion is accompanied by **plantar flexion of the foot** and **adduction of the forefoot**

Muscles producing movements of inversion

- **Main muscles-** **tibialis anterior, tibialis posterior**
- **Accessory muscles-** flexor hallucis longus, flexor digitorum longus

### Eversion

**Eversion** is a movement in which the **lateral border of the foot is elevated**, so that the **sole faces laterally**.

- Eversion is accompanied by **dorsiflexion of the foot** and **abduction of the forefoot**

Muscles producing movements of Eversion

- **Main muscle-** **peroneus longus, peroneus brevis**
- **Accessory muscles-** peroneus tertius

These movements can be performed voluntarily only when the foot is **off the ground**.

- When the foot is on the ground these movements help to adjust the foot to uneven ground.

## Joints Taking Part

**Main:**

1. Subtalar
2. Talocalcaneonavicular

**Accessory:**

- Transverse tarsal which includes **calcaneocuboid** and **talonavicular** joints.

### Axis of Movements

- Inversion and eversion take place around an **oblique axis**.

### **Range of Movements**

1. Inversion is much more free than eversion.

# Family Planning and Contraception

## CONTRACEPTION

---

Contraception means “**to prevent pregnancy**”

- It is also called **birth control, family planning.**
- Fertility control techniques may be **temporary or permanent.**

**Several methods are available for fertility control described below...**

### RHYTHM METHOD (SAFE PERIOD)

---

It is based on the time of ovulation.

- After ovulation, i.e. **on the 14th day** of menstrual cycle, the ovum is fertilized. Its **viability is only for 2 days after ovulation**
- **Sperms survive only for about 24 to 48 hours** after ejaculation.
- **If sexual intercourse occurs during this period** there is chance of pregnancy. This period is called the **dangerous period.**
- **Pregnancy can be avoided if there is no sexual intercourse during this period.**
- The prevention of pregnancy by avoiding sexual mating during this period is called rhythm method or safe period.

### MECHANICAL BARRIERS – PREVENTION OF ENTRY OF SPERM INTO UTERUS

---

Mechanical barriers are used **to prevent the entry of sperm** into uterine cavity.

These barriers are called **condoms.**

#### Male condom

- It is a leak proof sheath, made of latex.
- It **covers the penis** and does not allow entrance of semen into the female genital tract during coitus.

#### Female condom

- In females, the commonly used condom is **cervical cap** or **diaphragm.**
- It **covers the cervix** and **prevents entry of sperm into uterus.**

”

### CHEMICAL METHODS

Chemical substances, **which destroy the sperms**, are applied in female genital tract before coitus.

- Destruction of sperms is called **spermicidal action.**
- The spermicidal substances are **available in the form of foam, tablet, jelly, cream and paste.**

## ORAL CONTRACEPTIVES (PILL METHOD)

---

Oral contraceptives are the drugs taken by mouth (pills) to prevent pregnancy. These pills prevent pregnancy by

- **inhibiting maturation of follicles and ovulation**
- Progesterone **increases the thickness of mucosa** in cervix, which is not favorable for transport of sperm.

These pills **contain synthetic estrogen and progesterone**.

**Contraceptive pills are of three types:**

### 1. COMBINED PILLS

- Combined pills contain **synthetic estrogen like ethinyl estradiol and synthetic progesterone like norgestrol**.
- Pills are taken **daily from 5th to 25th day of menstrual cycle**.
- The **withdrawal** of the pills after **25<sup>th</sup> day** causes menstrual bleeding.
- The intake of pills is **started again after 5th day of the next cycle**.

### 2. SEQUENTIAL PILLS

Sequential pills contain estrogen along with progesterone.

- These pills also prevent ovulation.
- Sequential pills are **taken in two courses**

### 3. MINIPILLS OR MICROPILLS

Minipills contain a **low dose of only progesterone**

- Taken throughout the menstrual cycle.

”

### DISADVANTAGES AND ADVERSE EFFECTS OF ORAL CONTRACEPTIVES

Following are the disadvantages and adverse

- May **not be suitable for women** having disorders such as **diabetes, cardiovascular diseases or liver diseases**
- **Hypertension and heart attack**

### QUE. INTRAUTERINE CONTRACEPTIVE DEVICE (IUCD)

---

Fertilization and the implantation of ovum are prevented by **inserting some object made from metal or plastic into uterine cavity**.

- Such object is called **intrauterine contraceptive device (IUCD)**.

### „ MECHANISM OF ACTION OF IUCD

- Prevents fertilization and **implantation of the ovum**.
- The **IUCD with copper** content has **spermicidal action** also.

- The **IUCD which is loaded with synthetic progesterone** slowly releases progesterone.
- Progesterone causes thickening of cervical mucus and prevents entry of sperm into uterus.

**It is inserted into the uterine cavity by using some special applicator.**

”

### **DISADVANTAGES OF IUCD**

- Cause heavy bleeding in some women
- Promote infection
- Come out of uterus accidentally.

## **SURGICAL METHOD (STERILIZATION)**

---

### **PERMANENT METHOD**

- **Permanent sterility** is obtained by **surgical methods**. It is also called sterilization.

### **TUBECTOMY**

In tubectomy, the **fallopian tubes are cut and both the cut ends are ligated [closed]**

- It prevents entry of ovum into uterus.
- The operation is **done through vaginal orifice** in the **postpartum period**.
- During other periods, **it is done by abdominal incision.**
- Tubectomy is done quickly (in few minutes) by using a laparoscope.
- Though **tubectomy causes permanent sterility**
- Its **reversible**- If necessary **recanalization** of fallopian tube can be done using plastic tube by another surgical procedure.

### **VASECTOMY**

In vasectomy, the vas deferens is cut and the cut ends are ligated.

- So the **sperms cannot enter the ejaculatory duct** and the semen is devoid of sperms.
- It is **done by surgical procedure** with **local anesthesia**.
- If necessary, the **recanalization** of **vas deferens** can be **done with plastic tube.**

## SURROGACY OR SURROGATE MOTHER

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**Defination-** The practice by which a **woman** (called a surrogate mother) becomes pregnant and gives birth to a baby in order to give it to someone who cannot have children

There are **two kinds of surrogate mothers.**

### Traditional surrogates.

- **Artificial insemination** first made surrogacy possible.
- **A traditional surrogate** is a woman who is artificially inseminated with the father's sperm.
- She then **carries the baby and delivers it for the parents to raise.**
- A **traditional surrogate** is the **baby's biological mother.** That's because it was her ovum that was fertilized by the father's sperm.
- **Donor sperm** can also be used for a traditional surrogacy.

### Gestational surrogates.

- In vitro fertilization (**IVF**) now makes it possible to **take ovum from the mother, fertilize them with sperm from the father,**
- And **place the embryo into the uterus** of a gestational surrogate.
- The surrogate then carries the baby until birth.
- A gestational surrogate **has no genetic ties to the child.**
- **That's because it wasn't her ovum that was used.**

**Gestational surrogacy has become more common than a traditional surrogate because of less legal complications.**

**A woman decides to use a surrogate for several reasons:**

---

- She may have **medical problems with her uterus.**
- She may have **had a hysterectomy [removal of uterus.]**
- There may be **conditions that make pregnancy impossible** or medically risky, such as severe heart disease.

### **Few criteria for selecting a surrogate mother**

---

- She is at least 21 years old,
- She has already given birth to at least one healthy baby
- Has passed a psychological screening by a mental health professional
- **Willingly signs a contract agreeing to her role and responsibilities in the pregnancy.**

# Genetics



## KARYOTYPING

Karyotyping is the **procedure to obtain karyotype** of an individual.

- In this procedure, **Metaphase chromosomes** of a cell are obtained and photographed.
- From this photograph individual chromosomes are cut and arranged according to standard classification.

**For preparation rapidly dividing cells are used.**

They **can be obtained from following sources:**

- Lymphocytes from blood
- Fibroblast of skin
- Bone marrow cells

Most commonly used cells are **lymphocytes from peripheral blood.**

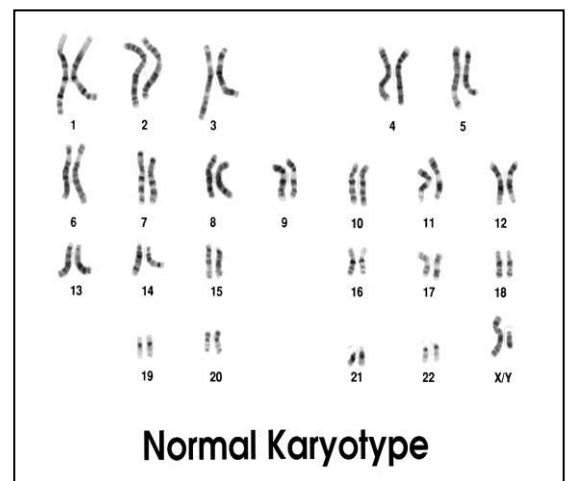
Following steps are involved

- 5 ml of venous blood is collected and mixed with heparin for avoiding clotting
- Lymphocytes are separated from other cells
- They are put into culture media
- **Phytohaemagglutinin** which **stimulates the cell division** is added into the culture
- The culture is kept in **incubator for three days at 37° temperature**
- At the end of three day **colchicin** is added to culture
- Colchicin has the property to **arrest cell division during metaphase by preventing formation of spindles.**

These cells are put into hypotonic saline. Cells will be enlarged and **chromosomes are separated**

- Cells are then fixed by **glacial acetic acid** and **methanol**.
- When cells rupture, chromosomes spread in large area known as **metaphase spread**.
- Those slides are **stained and photographed**
- From the photograph **individual chromosome is cut and arranged.**

**Thus, a karyotype of an individual is obtained.**



## TRISOMY 21 OR DOWN'S SYNDROME

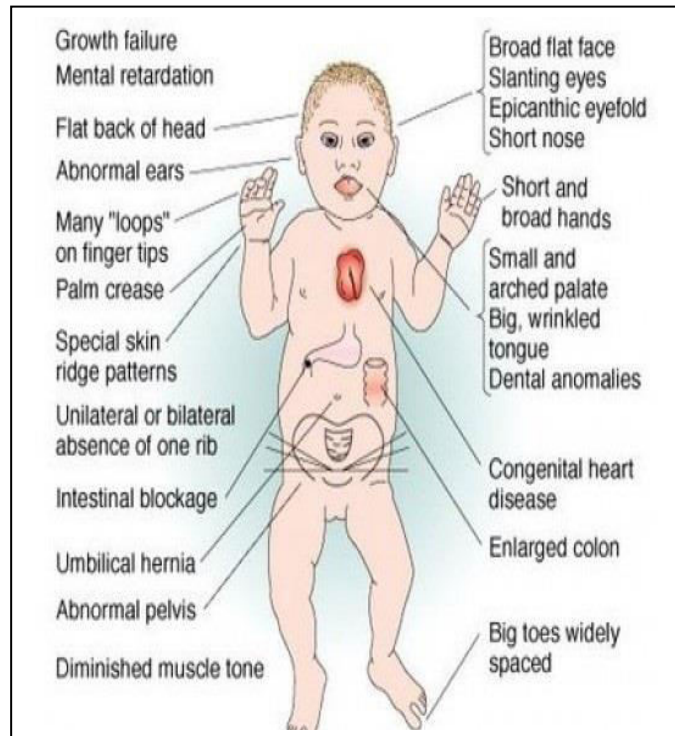
Incidence- 1 in 700 live births

### Genetic abnormality

It occurs due to chromosomal abnormalities – Trisomy of 21 chromosome

### Clinical features

- **Mentally retarded.**
- **IQ is low.**
- Poor growth.
- **Short stature**
- Poor muscle tone.
- Small head , **protruding tongue,**
- Small ears and nose
- **Hands are short and broad.**
- **Single palmer crease**
- Many children suffer from **major heart defect.**
- **Abnormal pelvis**



### Cause

- 21 chromosome trisomy occur due to non disjunction during maternal meiosis
- Incidence increases with **advancing maternal age [After 35 years of age]**
- **Recurrence risk is high when one child is already affected by down's syndrome**

### Life span

- The mean age is **16 years**. It may varies from few weeks to decades also
- **Most affected adults develop Alzheimer's disease**

### Counselling

Prenatal diagnosis of Down's syndrome can be carried by following methods

- **Amniocentesis**
- **Triple test- Alpha feto protein and estriol level is decreased and chorionic gonadotropin level is increased in Down's syndrome**

## TURNER SYNDROME [45, XO] OR MONOSOMY

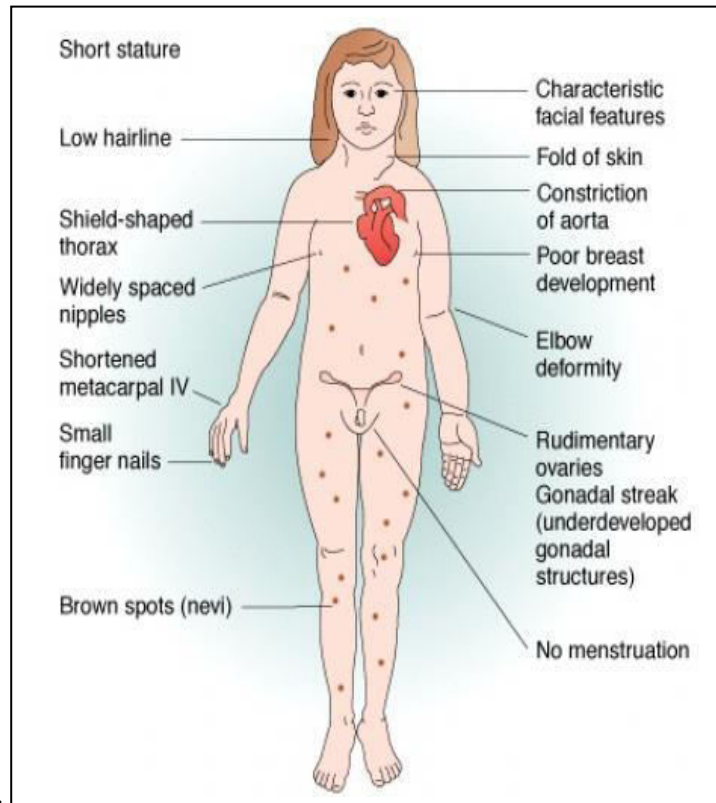
Incidence- 1 in 5000 to 10000 live births

### Genetic abnormality

It occurs due to chromosomal abnormalities – monosomy of X chromosome

### Clinical features

- **Affected individual is female**
- **Normal intelligence**  
**Or slightly retarded.**
- **Webbed Neck**
- Low posterior hair line
- **Short stature**
- Cubitus valgus
- Broad chest
- Widely spaced nipples
- **Poor breast development**
- **Ovary –non functional**
- Menstrual abnormality
- Female is sterile. She is not  
**Able to have child.**
- Secondary sexual characteristic is  
Underdeveloped
- **Coarctation of aorta**



### Cause

- Monosomy of X chromosome is the most common cause for turner's syndrome [45, XO]

### Counselling and Treatment

- **Oestrogen replacement therapy** should be given at adolescent age for development of secondary sexual characteristics
- Females are sterile so **they can have child with the help of "in vitro Fertilisation"**

## KLINEFELTER SYNDROME [47,XXY]

Incidence- 1 in 1000 live births

### Genetic abnormality

It occurs due to chromosomal abnormalities – **47,XXY**

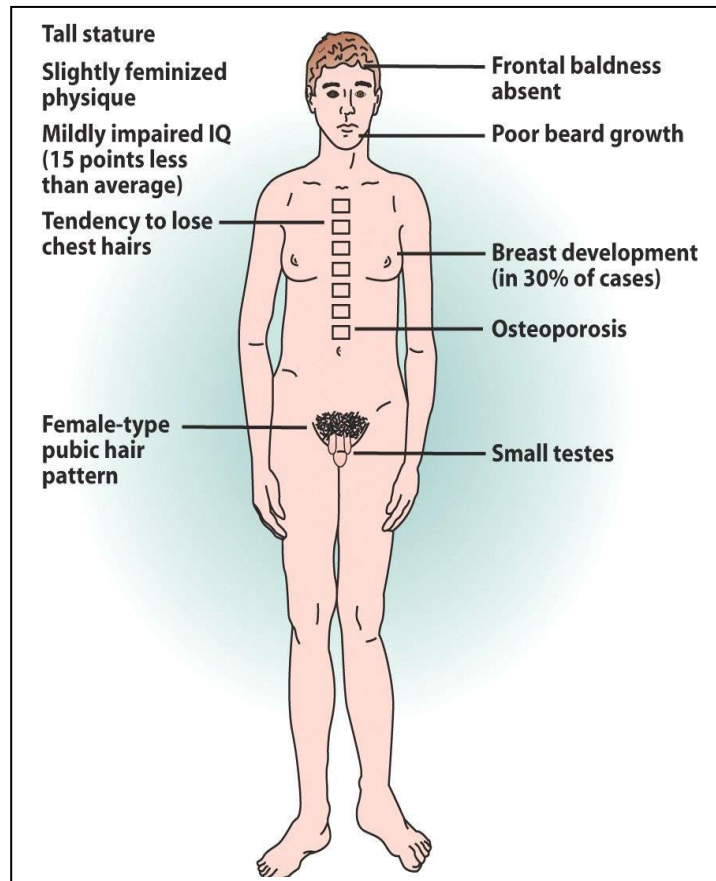
### Clinical features

- **Affected individual is male**
- **Normal intelligence**  
Or slightly retarded.
- **Tall stature**

### Secondary sexual characteristic is

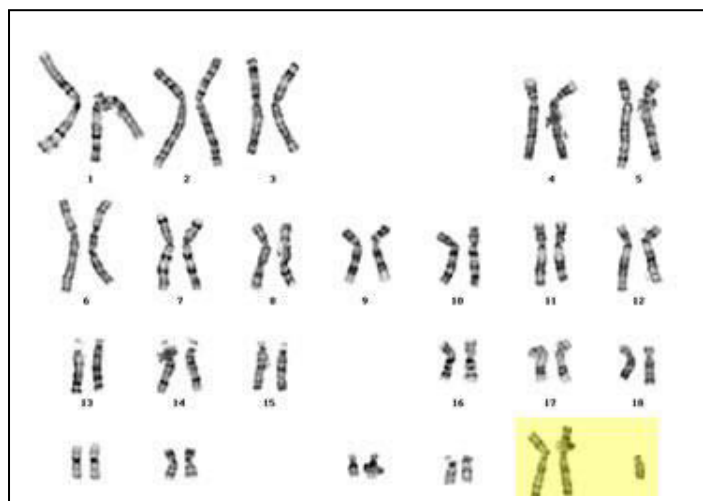
#### Underdeveloped

- Pubic hair pattern is like female
- Poor facial hair growth
- **Gynecomastia [ breast Development]**
- **Testis are small.**
- Normal penis and scrotum
- male is infertile. he is not Able to produce sperm



### Karyotype-

- **47 XXY**
- It's trisomy of sexual Chromosome



### Counselling and Treatment

- At the Age of puberty **treatment with testosterone will help to develop the secondary sexual characteristics.**


# Embryology

## SOMITES


---

Paraxial mesoderm becomes segmented to form somites


- They develop on the sides of developing neural tube
- It's a triangular structure
- It is divisible into three parts

 **Ventromedial part** – it is called **sclerotome**.

- The cells of this part migrate medially. They surround the neural tube.
- They give rise to vertebral column and ribs.

 **Lateral part**- It is called **dermatome**

- The cells of this part migrate and reach ectoderm.
- These cells form dermis of the skin and subcutaneous tissue.

 **Intermediate part** – It is called as **myotome**.

- **This part** forms skeletal muscles.
- Cervical, thoracic, lumbar, and sacral nerve innervate corresponding myotome
- Somites **exceed the number of spinal nerves** but many of them **subsequently degenerate**

## PRIMITIVE STREAK

---

- In **blastocyst** inner cell mass is arranged into **two plates**
- The upper layer towards amniotic cavity is the **epiblast**. Cells of this layer are **columnar**.
- The **lower layer** towards the yolk sac is the **hypoblast**. Cells of this layer are **cubical**.
  
- ❖ **At one circular area near margin of the disc, cubical cells of the hypoblast become columnar. This area is called the prochordal plate.**
  - It determines the central axis of the embryo
  - And also determines the head and tail ends.
  - Soon after formation of the prochordal plate,
  - **epiblast cells** lying along central axis **near the tail end of the disc** begin to **proliferate**.
  - Those cells form an **elevation that bulges into amniotic cavity**.
  - **This elevation is called the primitive streak**
  - **Primitive streak** is at first rounded or oval swelling.
  - With elongation of the embryonic disc, it becomes a **linear structure**.
  - Linear structure **lying in the central axis of the disc**.

**The cells that proliferate in the region of the primitive streak pass side ways.**  
They pushing themselves between the epiblast and hypoblast.

- ❖ **These cells form the intra embryonic mesoderm.**
- ❖ Some cells displace hypoblast and form layer which is now known as endoderm
- ❖ Thus both endoderm and mesoderm are derived from the epiblast.
- ❖ The remaining cells of epiblast **now form ectoderm**.

The process of formation of the primitive streak , endoderm, intra-embryonic mesoderm is referred as **gastrulation**.

## NOTOCHORD

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Notochord is a **midline structure** that develops in the region lying **between** the **cranial end** of the **primitive streak** and **caudal end** of the **prochordal plate**.

- During development, notochord passes through several stages,
- The **cranial end of the primitive streak** becomes thickened to form **primitive knot**
- A **depression** appears in the primitive knot known as **blastopore**
- Cells in the primitive knot multiply and **pass cranially in the midline**
- They pass in **between ectoderm and endoderm**
- They reach up to **caudal end of the prochordal plate**
- These cells form a **solid chord** known as **notochordal process**
- This process undergoes **several stages of rearrangements** and form **definitive notochord**.
  - Blastopore cavity extends into the notochordal process and convert it into a tube called **notochordal canal**
  - **Floor cells of notochordal canal** becomes mixed up with the endoderm
  - Gradually the **canal become flattened** and becomes a plate like structure called as **notochordal plate**
  - This process is reversed and notochordal plate again becomes curved and **forms a tube**.
  - Then tube is converted into a **solid rod** which is known as the **definitive notochord**.

Notochord enlarge in the midline

- Then that position is taken up by vertebral column.
- Notochord persists in the region of intervertebral disc as **nucleus pulposus**.



## PHARYNGEAL ARCHES

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- They are thickening of mesoderm present in the wall of foregut.
- At first there are six arches. The fifth arch disappears and only five remain.
- Between two arches, the endoderm is pushed **outwards to form a series of pouch**
- Opposite the each pouch the surface **ectoderm dips inwards as an ectodermal cleft**
- From each arch different muscles, bones and cartilages are formed
- It is described below

### First pharyngeal arch

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#### Mandibular arch

##### Skeletal

- Malleus & Incus of the middle ear
- maxilla & mandible
- spine of sphenoid bone
- Sphenomandibular ligament
- palatine bone

##### Muscles

##### Muscles of mastication

- Masseter
- medial & lateral pterygoid muscles
- Temporalis muscles
- Mylohyoid muscle
- anterior belly of Digastric muscle,
- Tensor palati muscle
- Tensor tympani muscle

##### Nerve supply

- **Mandibular Nerve**

### Derivatives of 2<sup>nd</sup> pharyngeal arch

---

#### Skeletal and

- Stapes,
- Temporal styloid process,

- Stylohyoid ligament, and
- Lesser cornu of the hyoid bone.

### Muscles

- Muscles of face
- Occipitofrontalis muscle
- Platysma
- Stylohyoid muscle
- Posterior belly of Digastric
- Stapedius muscle
- Auricular muscles

### Nerve supply

- Facial nerve

### Derivatives of 3<sup>rd</sup> pharyngeal arch

---

#### Skeletal

- **Greater** cornu of hyoid bone
- **Lower part of the body of hyoid bone**

#### Muscles

- Stylopharyngeous

#### Nerve supply

- Glossopharyngeal nerve

**Cartilages of the larynx** are derived from the fourth and sixth pharyngeal arches

#### 4<sup>th</sup> pharyngeal arch

Muscles- cricothyroid muscle, all intrinsic muscles of soft palate *except* tensor veli palatini

Nerve- **superior laryngeal nerve**

#### 6<sup>th</sup> pharyngeal arch

Muscles- All intrinsic muscles of larynx except the cricothyroid muscle

Nerve- **Recurrent laryngeal nerve**

## DEVELOPMENT OF FACE

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Face develops from frontonasal process and right and left mandibular arches  
( First pharyngeal arch)

- The mandibular arch divides into maxillary process and a mandibular process

### **Lower lip and lower jaw**

➤ The right and left mandibular processes meet in the midline and fuse  
They form lower lip and lower jaw

### **Upper lip**

- It is formed by the fusion of the frontonasal process with the right and left maxillary process

### **Cheeks**

- Cheeks are formed by fusion of the maxillary and mandibular processes

### **Nose**

- It is derived from the frontonasal process

### **Nasal cavity**

- The nasal placode gets depressed and forms a nasal pit
- That nasal pit enlarges to form the nasal cavity

### **Paranasal air sinuses**

- They appear due to outgrowth from the nasal cavity

### **Palate**

- It is formed by fusion of three components
- **Right and left palatal process** arising from maxillary process and **primitive plate** which is derived from the frontonasal process

# Histology

## Cartilage

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- It is a specialized connective tissue
- It consist of three components
  - Ground substance
  - Fibers and
  - Cells.
- Three types of cartilage are found in the body
  1. Hyaline cartilage
  2. Elastic cartilage
  3. Fibro cartilage
- They differ from each other because of the type and amount of fibers present in them.
  - Cartilage is not supplied with blood vessels
  - It is avascular
  - It is usually surrounded by membrane called as perichondrium.
  - Perichondrium having reach blood supply.
  - Chondrocytes receive nutritive substance by diffusion through the ground substance.

## HYALINE CARTILAGE

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It is the most abundant type of cartilage in human Body.

### Location:

- In fetal skeleton,
- Ends of adult Bones,
- Nose,
- Costal cartilage,
- Trachea, bronchi and larynx.

### Description:

- It consist of homogeneous, transparent and amorphous intracellular matrix.
- Matrix consist of collagen fibers and ground substance

- Cartilage cell known as chondrocytes
- Chondrocyte is present in small spaces called as **lacunae**.
- It is surrounded by perichondrium

### Fibers

- Its type 2 collagen fibers
- It is provide stability and strength to the cartilage
- They are not seen in the histological section because they have same refractive index as that a ground substance.

### Ground substance

- Homogenous, gel like structure.

### Chondrocytes

- They occupy lacunae in the matrix.
- They are responsible for the synthesis of collagen fibers and ground substance.



### Perichondrium

- Hyaline cartilage on its free surface covered with a fibro vascular membrane called as perichondrium.
- It is absent at the free surface of bone at joint cavity. Known as [articular cartilage]
- It is consist of two layers
  1. Outer fibrous layer.
  2. inner cellular layer

### Functions

- Articular cartilage provides smooth surface for movement of joints.
- It is provides support [as in costal cartilage]
- Firmness keeps the lumen of trachea and bronchi patent.

## ELASTIC CARTILAGE

### Location

- It is present in pinna of the ear.
- Epiglottis
- Corniculate
- Cuneiform cartilage of larynx.
- External auditory meatus and auditory tube.

### Description

- Also known as “yellow elastic cartilage”

### Fibers

- Elastic cartilage contains branching elastic fibers.
- Contains type 2 collagen fibers.

### Ground substance

- Contains proteoglycans.

### Cells

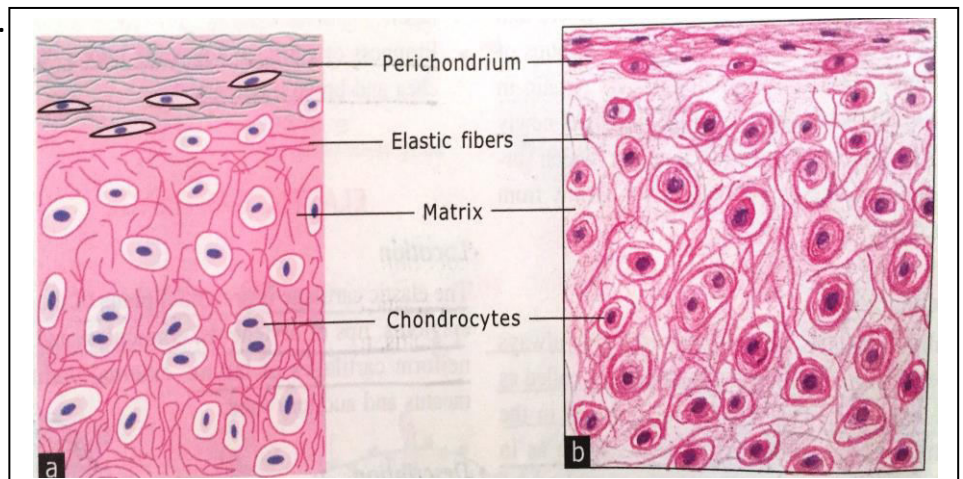
- Chondrocytes are present in lacunae.
- These cells are bigger than cells present in hyaline cartilage.
- They are closely placed.

### Perichondrium

- Having two layer
  - (1) Outer fibrous layer
  - (2) Inner cellular layer.

### Function.

- It provides shape and support to the organ.



## FIBROCARILAGE

- It is also known as “white fibrocartilage”

### Location

- Intervertebral discs
- Public symphysis
- Manubriosternal joint
- Menisci of knee joint
- Articular disc of temporomandibular and sternoclavicular joints

### Description

#### Fibers

- Type-1 variety

#### Ground substance

- Very less variety.

#### Cells

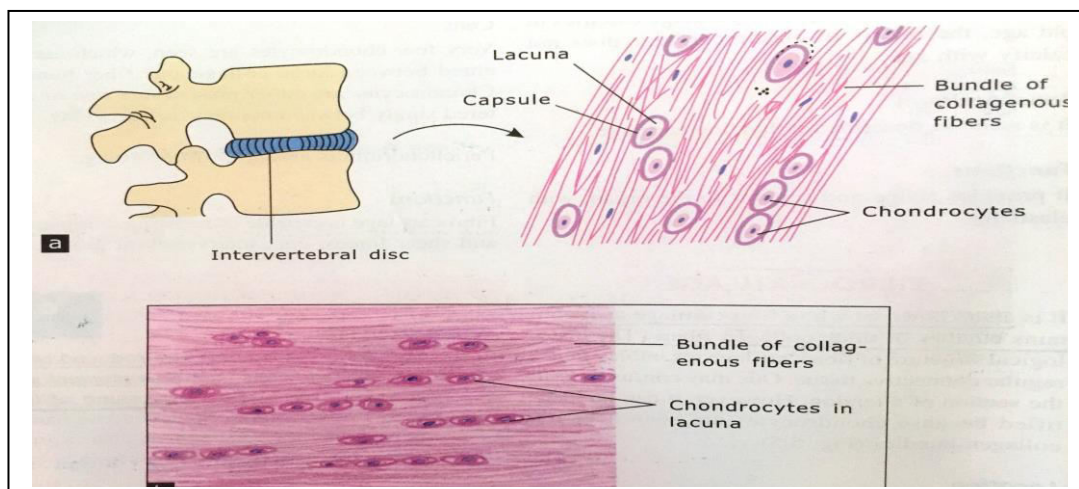
- Very few chondrocytes are seen
- They are placed between large fiber bundles

#### Perichondrium

- It's absent in fibrocartilage.

#### Function

- It is capable of **resisting compressive** and **shear forces**.





## SKELETAL MUSCLE

They are also known as striated or voluntary muscle.

- They are **supplied by somatic nerves**
- Under light microscope it shows alternating dark and light bands
- Skeletal muscle consists numerous muscle fibers

### Covering

- Each **individual muscle** fiber is surrounded by a covering known as **endomysium**
- **Many muscle fibers** aggregate to form **bundle** which is surrounded by a layer called as **perimysium**
- **Many bundles** unite to form a muscle which is covered by **epimysium**.

The point of contact between terminal end of axon and muscle fiber is called **motor end plate**.

Basic unit of skeletal muscle is long **cylindrical fiber**. Fiber is **formed by fusion of many myoblast**

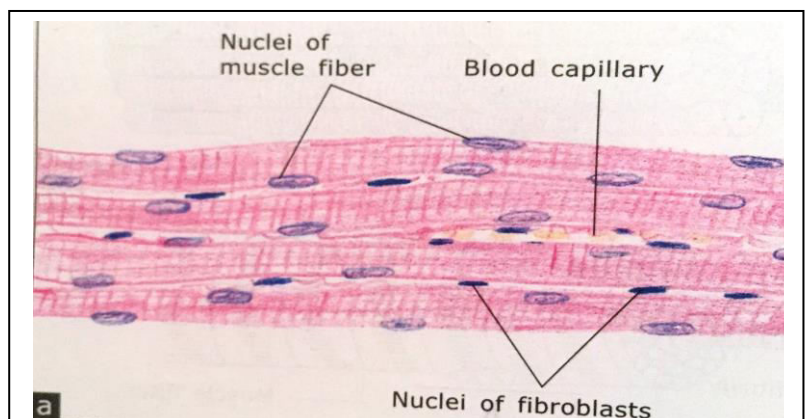
- **Nuclei of cells** are present **towards peripheral** part of cytoplasm

### **Striations**

- The **dark band** is called as “**A**” band and **Light band** is called as “**I**” band
- A thin line is seen in the middle of the light area is called as **Z line**
- The mid region of the dark band is called as **H band**
- In the middle of the H band the line is known as **M line**

**The area between two adjacent Z lines called as Sarcomere.**

- A sarcomere is the **contractile unit of muscle**
- It's containing **thick myosin** and **thin actin filaments**



## CARDIAC MUSCLE

Cardiac muscle is also **striated** similar to skeletal muscle but its **contraction is involuntary**.

- They are supplied by **autonomic nerves**
- They are **present only in heart**.

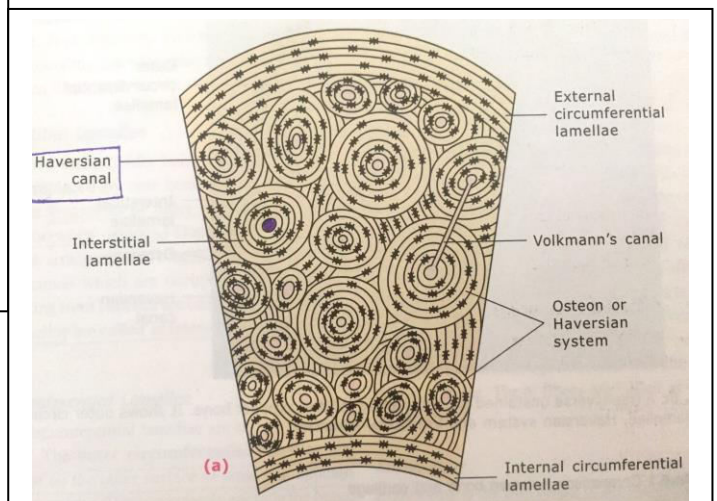
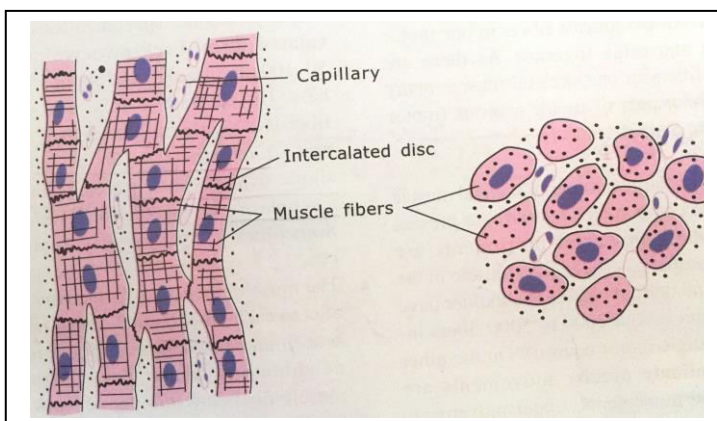
Cardiac muscle is consisting of **long and thick** muscle fibers

- These fibers **show branching**
- So, individual fiber **appears as “Y” shaped**.
- Each fiber is made up of **cardiac myocytes**.
- Each myocyte has a **centrally placed single oval nucleus**.
- They are joined and form a junction known as **intercalated disc**.
- **Gap junctions** are present in the **longitudinal or lateral portion of intercalated disc**. **It helps in spreading of action potential**

**Myofibrils of cardiac muscle have actin and myosin filaments.**

### Applied

- **Hypertrophy of cardiac muscle** – when cardiac muscle works excessively their size is enlarged.
- **No capacity for regeneration**
- **Damaged part is replaced by fibrous tissue**.



## COMPACT BONE

---

It forms the **bulk of the diaphysis** of long bone

- It forms a **thin layer on the external surface of all other bones.**
- This part of **bone is called compact because no space is visible on naked eye examination**

### **Bone core is made up of spongy bone**

#### **Compact bone covering**

**Periosteum**- the bone on its external surface is covered by a membrane called periosteum

- It consists two layer – outer fibrous layer and inner cellular layer.

**Endosteum** – It is the **thin lining** of the bone **towards marrow cavity** and spongy bone

Compact bone is made up of Lamella.

Lamellae are present in three different patterns

### **Haversian system of lamellae**

Also known as osteon

Lamellae Arranged around a canal known as **Haversian canal**. This canal is **containing vessels and lymphatics**.

Blood vessels and nerves go inside the compact bone through **volkmann's canal**

### **Interstitial lamellae**

Lamellae seen in areas between osteon is known as interstitial lamellae

### **Circumferential lamellae**

It is two types

**Outer circumferential lamellae**- present **on the outer surface of bone** just below periosteum.

**Inner circumferential lamellae**- It **encircle the marrow cavity**

### **Clinical application**

- ❖ **Rickets**- poor mineralization of bone due to **vitamin d deficiency in child** results in bowing of legs known as rickets.

## ARTERY

Arteries are vessels which conduct blood from heart to tissue.

The wall of the artery is having three layers.

### Tunica intima

- **Innermost layer of artery.**
- It is having **four components**
  - **Endothelium**- made up of **simple squamous epithelium.**
  - **Basal lamina**
  - **Subendothelial connective tissue**
  - **Internal elastic lamina**- made up of a layer of elastic lamina

### Tunica media

- Intermediate layer
- It is the thickest layer and **consisting of elastic fibers and smooth muscle cells**
- The **amount of elastic fibers and smooth muscle** is depending upon the **size of artery**
- **They arranged circularly**
- It is **separated** from **tunica adventitia** by **external elastic lamina**

### Tunica adventitia

- Outermost layer of artery
- Made up of **connective tissue cells and collagen fibers**

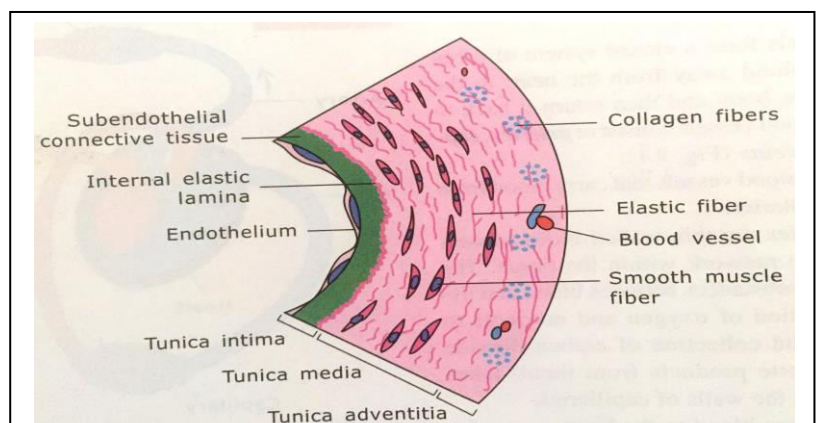
## Classification of arteries

### Into three types

- **Elastic arteries**- larger arteries ex. Common carotid, subclavian artery
- **Muscular arteries**- medium sized arteries.
- **Arterioles**- Smaller arteries. Terminating into capillaries.

### Clinical

**Atherosclerosis**- deposition of lipid, fibrous tissue in tunica intima



## THYROID GLAND

It is **surrounded** by thin connective tissue **capsule**.

- From the capsule **septa** extend into gland **carrying blood vessels** along with them

### Parenchyma

- The **parenchyma** of the gland is arranged in the form of **thyroid follicles**.

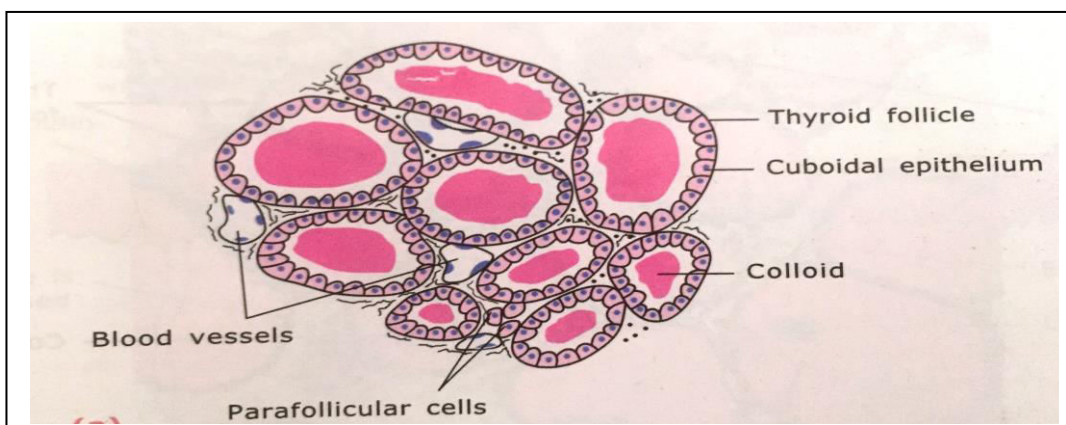
#### Thyroid follicles

- Follicles are having **central cavity** that **contains gel like material** called **colloid**.
  - **Colloid is containing thyroglobulin.**
  - Thyroglobulin is the **storage form of thyroid hormones**
- Follicles are lined by a **single layer of epithelium**
- Epithelial cells of **follicle vary in size from cuboidal to columnar**
- It depends on the activity of cells
  - **Cuboidal cells** reffered as “**resting stage**”
  - **Coloumnar cells** reffered as “**active**” or “**secratory stage**”

Each follicle is **surrounded** by a network of **reticular fibers, vessels and lymphatics**

#### Parafollicular cells

- Few cells present **surrounding follicular cells** called as **parafollicular cells**
- **They secrete hormone calcitonin.**





## SPLEEN

The structure of the spleen is **similar to the lymphnode**.

### **capsule**

- It is covered with a **capsule**. That capsule is made of dense connective tissue and elastic fibers.

**A cut section** through the spleen shows the substances of **spleen arranged in the form of white pulp and red pulp**

### **The white pulp**

The white pulp appears **basophilic** (bluish) in the **haematoxylin** stained section because it **contains lymphocytes**.

### **The red pulp**

- The red pulp appears red because it **contains many sinuses filled with RBC**.

### **Circulation of blood through spleen**

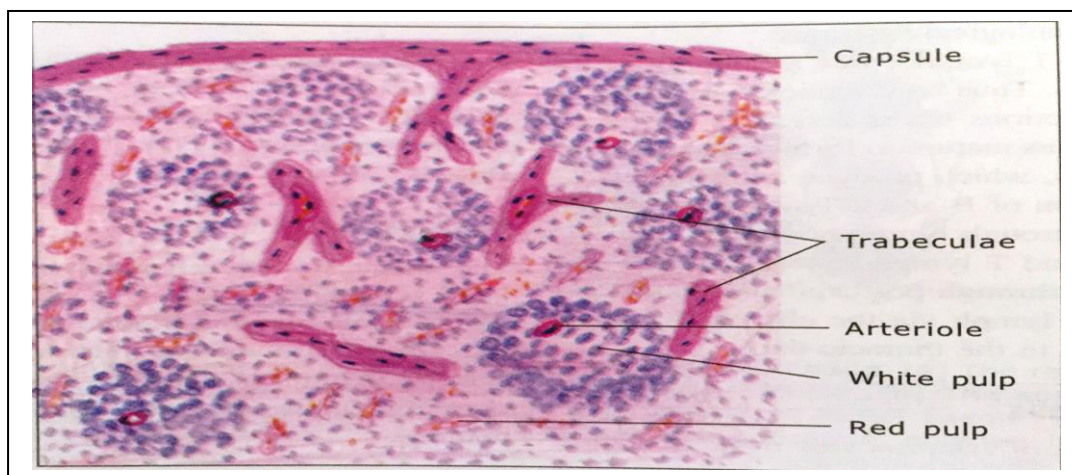
- Splenic artery enters at hilum . It is branched and enters the pulp where it is covered by lymphocytes
- That **periarteriolar lymphatic sheath** is called as **white pulp**.
- At the center of this pulp is the **central artery**
- There are two theories of circulation **open and closed circulation**

### **Functions of spleen**

- Filtration of blood
- Site of production of B and T lymphocytes
- Destruction site for RBC

### **Applied**

- **Splenomegaly**- enlargement of the spleen is called as spleenomegaly.
- It occurs in **malaria and leukaemias**.



## APPENDIX

---

Appendix is a worm like diverticulum attached at the caecum

- It's wall contains all four layers typical of intestinal tract.

### 1. Mucosa-Innermost layer.

#### Epithelium of mucosa

- It is made up of columnar epithelium. Also contain goblet cells.

Lamina propria of mucosa- this is a layer of loose connective tissue, which support the epithelium

- It contains the **blood and lymphatic vessels**.
- It is **occupied with many large and small lymphatic nodules**. These may extend upto submucosa.
- **Lymphatic nodules can be enlarged** and can block the lumen of appendix.

#### The muscularis mucosa

- It consists of thin **layer of smooth muscle**. These are arranged as inner circular and outer longitudinal layer.
- It **helps in changing the shape of mucosa**
- It is disrupted where lymphatic nodule extend to submucosa

### 2. Submucosa

- It consist of **moderately dense connective tissue** rich in **collagen and elastic fiber**
- It contains blood vessels, lymphatics vessels and Nerves and **meissener's plexus**
- It may show **extension of lymphatic nodules**.

### 3. muscle layer

- muscle layer containing **inner circular** and **outer longitudinal** smooth muscle coats
- also contains **myentric plexus**

### 4. Serosa- the outer most covering

## SUPRA RENAL GLAND

The supra renal gland **consists of two structurally and functionally different parts.**

- **Centrally located – Medulla**
- **And outer - Cortex**

Cortex is divided in to three zones.

### Zona Glomerulosa-

- It is thin outer most layer
- The cells of this region are arranged in arches
- When it is sectioned it looks like cluster of balls, so known as glomerulosa
- **Mineralocorticoid** is produced from this layer.

### Zona Fasciculata

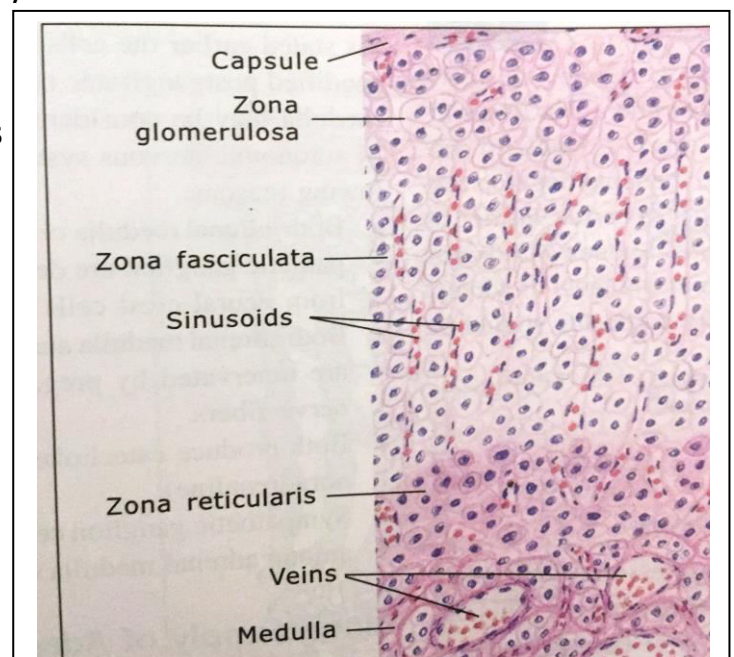
- Thick zone situated in the **middle of the cortex.**
- It is continuous superficially with zona glomerulosa and deeply by zona reticularis. No demarcation line is present between zones.
- Cells are **arranged into parallel columns**
- **Glucocorticoids** are produced from this layer.

### Zona Reticularis

- **It is situated adjacent to medulla**
- Cells are arranged in **three dimensional Network of branching and anastomosing cords.**
- **Androgens** are produced from this Layer.

### **Medulla**

- The cells of medulla are of **two types**
- **Norepinephrine and epinephrine** secreting cells.
- It is innervated by **preganglionic sympathetic fibers**





## TESTIS

It has a **thick white capsule** called as **tunica albuginea**.

**Tunica vasculosa** underlies the tunica albuginea

The **connective tissue** septa divides testis into about **250 compartments** called as **lobules**.

- Each lobule contain **one to three seminiferous tubules**.
- These **tubules are the sites where sperms are produced**.

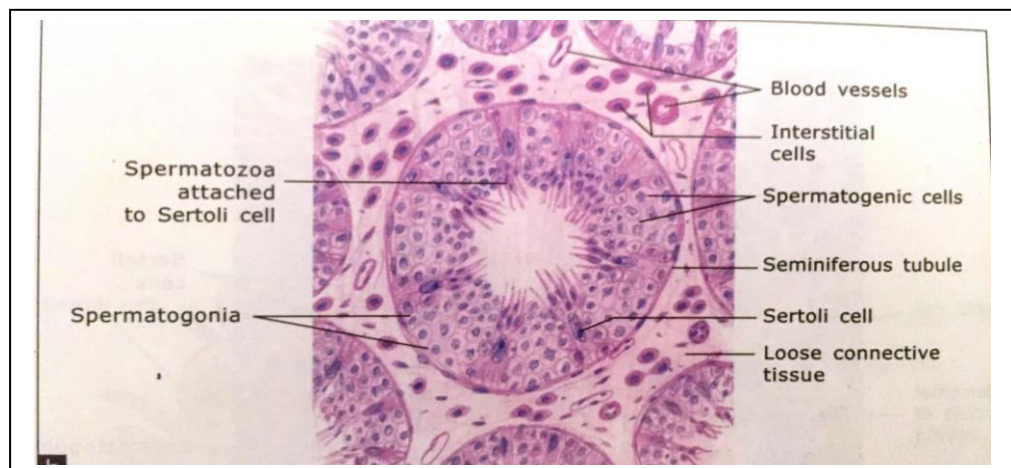
In between the seminiferous tubules there is **presence of loose connective tissue**.

It is known as **interstitial tissue**

- It is having **blood vessels**
- It **contains leydig cells which produce testosterone**

**Seminiferous tubules open into rete testis**

- Rete testis having **efferent ducts** which is **connected with epididymis**.



## OVARY

Ovaries are almond shaped paired structure

Each ovary measures about **3cm length, 1.5 cm width, 1 cm in thickness.**

**Each ovary contains following parts -**

**Germinal epithelium-**

- It is **covering** surface of ovary
- It is **single layered cuboidal or squamous epithelium**
- Name is misnomer because it does not give rise to germ cells.

**Tunica albuginea**

- It is connective tissue layer lying below germinal epithelium.

**Cross section of ovary shows outer cortex and inner medulla.**

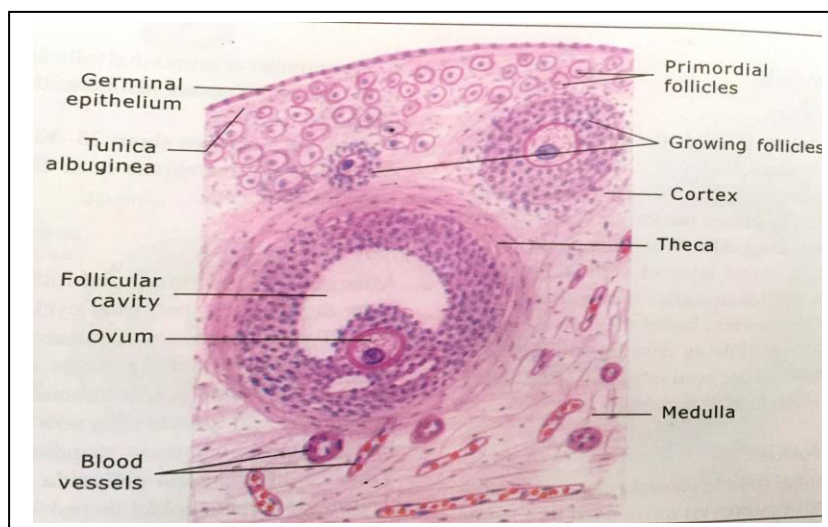
**Cortex**

- Lies below tunica albugenia
- It **contains germ cells. Ovarian follicles** formed here.
- Ovarian follicles are **in various stages of development**

**Medulla**

- It is present **deep to cortex.**
- It consists of **loose connective tissue.** And containing **lymphocytes, blood vessels, and nerves**

**The demarcation between cortex and medulla is not clear.**



## URETER

**Ureter is a tube with star shaped lumen inside**

- It conducts urine from renal pelvis to the urinary bladder

It's structure **containing three walls**

### Mucosa

- **Epithelium- transistional type of Epithelium** which is 4 to 5 layers thick
- **Lamina propria-** made up of **loose connective tissue** containing blood vessels and lymphatics

### Muscle layer

- **Inner longitudinal and outer circular layer of smooth muscle**

### Adventitia

- Outer most layer of ureter made up of loose connective tissue.

### Clinical

- **Ureter stone** – Stone in the ureter.
  - Kidney may **dislodge the stone** and **pass into ureter**.
  - It causes **severe pain radiating from back to front side at lower abdomen.**

